

# Development and evaluation of a web-application for stress management

Supporting behaviour change in persons with work related stress

Caroline Eklund

Video caroline eklund@mdh.se

**MIN STRESS**

- Har du navigerat
- Introduktion till Min Stresskontroll
- Uppleverer av stress, start
- Vad är stress?
- Vad är ABC-modellen?
- Exempel, ABC-modellen
- Min ABC-modell
- Uppleverer av stress i din ABC-modell
- Stressmätaren
- Uppleverer av stress, slutför
- Uppskatning av nöjdhets med resultat! [Se resultat](#)

**MIN TRÄNING**

- ✓ Avspänning
- ✓ Förändra negativa tankar
- ✓ Att hantera negativa känslor
- ✓ Time-management
- ✓ Öva sund självhövde
- ✓ Att upprätthålla goda vanor
- ✓ Sömn

Vad är stress?

Vad är stress

Resurser

Krav

0:41 / 1:00

Jag har sett videon, gå vidare



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No. 269

**DEVELOPMENT AND EVALUATION OF A WEB  
APPLICATION FOR STRESS MANAGEMENT**

**SUPPORTING BEHAVIOUR CHANGE IN PERSONS WITH WORK RELATED STRESS**

**Caroline Eklund**

**2018**



School of Health, Care and Social Welfare

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DEVELOPMENT AND EVALUATION OF A WEB  
APPLICATION FOR STRESS MANAGEMENT  
SUPPORTING BEHAVIOUR CHANGE IN PERSONS WITH WORK RELATED STRESS

Caroline Eklund

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Akademin för hälsa, vård och välfärd

## Abstract

Stress is the most common reason for sick leave in Sweden. Stress can lead to health-related problems such as burnout syndrome, depression, sleep disorders, cardiovascular disease and pain. It is important to handle stress at an early stage before it could lead to health-related problems. The web enables to reach many persons at a low cost. Web-applications have proven to be effective regarding several health-related problems. However, adherence is often low and many of the available stress management-programs have not been based on evidence. The overall aim of the thesis was to develop and evaluate a fully automated, evidence-based web-application for stress management for persons experiencing work related stress. The thesis compiles of four studies. Study I contained the systematic development of the program in three phases. Phase one included the development of the program's theoretical framework and content, and phase two consisted of structuring the content and developing the platform to deliver the content from. The third phase consisted of coding the behaviour change supporting content, validation of the program among experts and testing it with one possible end-user. The result was an interactive web-application tailored to the individual's need for stress management supporting behaviour change in several ways; My Stress Control (MSC). In study I, MSC was also tested regarding how to proceed through the program. The results showed that the participants had trouble to reach the program's end. In study II the feasibility of the coming RCT study procedure was investigated as well as how feasible MSC, the web-application, was to be applied in a larger study. 14 persons participated in study II. The findings proved the scientific study procedure feasible with minor changes, but some changes were required for the web-application to increase the chance for success in a larger, more costly study. In study III nine of the 14 persons that participated in study II were interviewed. The interviews aimed for a better understanding of how the participants experienced the program to further develop it. One theme was identified: Struggling with what I need when stress management is about me. It described an understanding for that stress management takes time and is complex but that it was difficult to find the time for working with it. In study IV, a randomized controlled trial, MSC was evaluated regarding its effect on stress. One group with access to MSC was compared to a wait-list group. 92 persons participated in study IV. The results showed that there were no significant between- or within group differences on perceived stress. A small effect size of MSC on perceived stress was shown between intervention- and wait-list groups, but adherence to the program was low.

These studies support that a web-application based on the evidence within multiple fields may have effect on perceived stress. However, to handle stress on one's own is complex and the paradox in having one more thing to do when already stressed contribute to a conflict on how to handle the task. How to facilitate adherence to the fully automated program should be further investigated in future studies.

*“I have been impressed with the urgency of doing. Knowing is not enough; we must apply. Being willing is not enough; we must do.”*  
*- Leonardo da Vinci*

# Abstract

Stress is the most common reason for sick leave in Sweden. Stress can lead to health-related problems such as burnout syndrome, depression, sleep disorders, cardiovascular disease and pain. It is important to handle stress at an early stage before it could lead to health-related problems. The web enables to reach many persons at a low cost. Web-applications have proven to be effective regarding several health-related problems. However, adherence is often low and many of the available stress management-programs have not been based on evidence. The overall aim of the thesis was to develop and evaluate a fully automated, evidence-based web-application for stress management for persons experiencing work related stress. The thesis compiles of four studies. Study I contained the systematic development of the program in three phases. Phase one included the development of the program's theoretical framework and content, and phase two consisted of structuring the content and developing the platform to deliver the content from. The third phase consisted of coding the behaviour change supporting content, validation of the program among experts and testing it with one possible end-user. The result was an interactive web-application tailored to the individual's need for stress management supporting behaviour change in several ways; My Stress Control (MSC). In study I, MSC was also tested regarding how to proceed through the program. The results showed that the participants had trouble to reach the program's end. In study II the feasibility of the coming RCT study procedure was investigated as well as how feasible MSC, the web-application, was to be applied in a larger study. 14 persons participated in study II. The findings proved the scientific study procedure feasible with minor changes, but some changes were required for the web-application to increase the chance for success in a larger, more costly study. In study III nine of the 14 persons that participated in study II were interviewed. The interviews aimed for a better understanding of how the participants experienced the program to further develop it. One theme was identified: Struggling with what I need when stress management is about me. It described an understanding for that stress management takes time and is complex but that it was difficult to find the time for working with it. In study IV, a randomized controlled trial, MSC was evaluated regarding its effect on stress. One group with access to MSC was compared to a wait-list group. 92 persons participated in study IV. The results showed that there were no significant between- or within group differences on perceived stress. A small effect

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**Keywords:** Internet; Behavior change; Behavior medicine; Health promotion





# List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

- I Eklund, C., Elfström, M. L., Eriksson, Y., & Söderlund, A. (2018). Development of the web application My Stress Control – integration of theories and existing evidence. *Cogent Psychology*, 5(1), 1489457. doi:10.1080/23311908.2018.1489457  
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- II Eklund, C., Elfström, M. L., Eriksson, Y., & Söderlund, A. (2018). Evaluation of a web-based stress management application – A feasibility study. *Journal of Technology in Behavioral Science*, 3(3), 150-160. doi: 10.1007/s41347-018-044-8  
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- III Eklund, C., Elfström, M. L., Eriksson, Y., & Söderlund, A. (2018). User experiences form a web-based, self-management programme: struggling with what I need when stress management is about me. *European Journal of Physiotherapy*. doi: 10.1080/21679169.2018.1468814  
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- IV Eklund, C., Söderlund, A., & Elfström, M. L. Evaluation of the web application My Stress Control, a stress management program for persons experiencing work related stress – a randomized controlled trial. *Manuscript submitted*.



# Contents

Abstract.....	2
1. Introduction.....	11
1.1 The health and welfare perspective.....	11
1.2 Perspective on stress.....	12
1.3 Stress and health.....	13
1.4 Theories and models for health-related behaviour change.....	14
1.4.1 Social Cognitive Theory (SCT).....	15
1.4.2 The Theory of Reasoned Action and the Theory of Planned Behaviour (TRA/TPB).....	16
1.4.3 The Transtheoretical Model (TTM) and the Stages of Change (SoC).....	16
1.4.4 The Transactional Model of Stress and Coping (TSC).....	17
1.4.5 Model for behaviour change in internet interventions.....	17
1.5 eHealth.....	18
1.6 Web-based interventions for stress management.....	19
2. Rationale.....	22
3. Aims.....	23
4. Methods.....	24
4.1 Settings and participants.....	25
4.2 Procedure.....	28
4.3 Data collection.....	29
Study I.....	29
Study II.....	32
Study III.....	33
Study IV.....	34
4.4 Data analyses.....	35
Study I.....	35
Study II.....	35
Study III.....	36
Study IV.....	36
4.5 Ethical considerations.....	37
5. Results.....	38

5.1 From an idea to a ready to use product.....	38
5.1.1 Assessing feasibility.....	40
5.1.2 Struggles and paradoxes as user experiences .....	42
5.1.3 Further development .....	42
5.2 Effects on stress of My Stress Control program .....	43
6. Discussion.....	48
6.1 Summary of results.....	48
6.2 Development and testing: an iterative process.....	49
6.3 Effectiveness of MSC.....	53
6.4 Stress, behaviour and behaviour change.....	54
6.5 Methodological considerations .....	56
6.6 Ethical discussion.....	59
7. Conclusions.....	62
8. Implications for future research.....	63
Acknowledgements .....	64
Sammanfattning på svenska.....	66
References.....	68
Appendix.....	79
Interview guide study III .....	81
Examples made of print screens from the My Stress Control program....	82
Online demo of the My Stress Control program.....	84

# Abbreviations

MSC	My Stress Control
ABC-model	Antecedent-Behaviour-Consequence model
AAAQ	Trippel AQ framework (Available, Accessible, Acceptable, good Quality)
CSS	Coping Self-efficacy Scale
DBCI	Digital Behaviour Change Intervention
FBA	Functional Behavioural Analysis
HADS	Hospital Anxiety and Depression Scale
ITT	Intention to Treat
MCQ	Motivation to Change Questionnaire
PSS	Perceived Stress Scale
QPS 34+	Nordic Questionnaire for Psychological and Social factors at work
RCT	Randomized controlled trial
SCT	Social Cognitive Theory
SySS	Symptoms of Stress Survey
TRA/TPB	Theory of Reasoned Action/Theory of Planned behaviour
TSC	Transactional model of Stress and Coping

TTM/SoC Transtheoretical Model/ Stages of Change

UWES Utrecht Work Engagement Scale

WHO World Health Organization

# 1. Introduction

## 1.1 The health and welfare perspective

In a welfare state, individuals' equal rights to health and to the welfare system are central. In Sweden, which is the context for the present thesis, different laws regulate the welfare system. One law that regulates the welfare system is the Health and Medical Services Act (SFS 2017:30). This law contains specifications regarding how the health care system is to work with both curative and palliative functions as well as also sickness prevention and health promotion practices. Despite the presence of such laws, today's demographic transitions, in Sweden (Statistics Sweden, 2015) and in other countries (WHO, 2011), towards an ageing population challenge the welfare system. Health-promotive actions may have to be refocused in favour of curative efforts and care of the ageing population by the health care system. These challenges drive the search for new, innovative solutions to support health promotion among citizens. Physiotherapists are an important group among health care staff to contribute to health-promotive actions (Dean et al., 2014; Dean & Söderlund, 2015; Dean, Umerah, Dornelas de Andrade, Söderlund, & Skinner, 2015), for example, in stress management (Bezner, 2015).

Digitalization is seen as a part of the solution within the health care sector as a tool to strengthen individuals' ability to participate more actively in their own life situations and thus become involved in managing their own health-related problems. Digitalization is a broad concept that includes a wide range of innovations from digital health care records to partly or fully digitalized interventions. The use of digital opportunities to support individuals' involvement in lifestyle-related health behaviours is the main focus of the present thesis.

A widely used definition of health by the World Health Organization (WHO) was adopted in 1948 and states that "*Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*" (WHO, 1948, no. 2, p. 100). A paradigmatic shift is reflected in the Alma-Ata Declaration developed in 1978 (WHO, 1978), in which health was viewed not simply as the outcome of biomedical interventions but also as the result of underlying determinants of health. There are several determinants, but they can be condensed into three areas: the social and economic environment, the physical environment, and the person's individual character-



istics and behaviours (Dahlgren & Whitehead, 1991). Health promotion enables individuals to increase their control over and identification of the determinants of health and thus to control their own health (WHO, 1978). The declaration expressed the need for protecting and promoting health in the population. The Bangkok Charter for Health Promotion 2005 made similar statements supporting that the same determinants should be addressed through health promotion (WHO, 2005). According to the WHO, promoting health is essential to human welfare and sustainable economic and social development (WHO, 1978). To address stress—for example, by providing information and tools for preventing ill health and sick leave due to stress—could thus be considered as essential not only for individuals and their employers but also for the welfare state.

The highest attainable standard for health and welfare support systems varies between countries, depending on the available resources, but must contain certain elements (Forman & Bomze, 2012). Four key elements essential for the right to health have been identified: Health-related interventions should be available, accessible, acceptable, and of good quality. The four elements forms the AAAQ framework (Backman, 2012; UN Committee on Economic Social and Cultural Rights, 2000). The framework concerns all health care facilities, goods and services, and the social determinants of health.

Stress is the primary reason for sick leave in Sweden today (Sweden's Social Insurance Agency, 2015). The statistics for sick leave are based on persons receiving financial compensation from the Swedish Social Insurance Agency and thus who have been on sick leave for a minimum of 14 days. Due to high sick leave numbers, it is important to increase the availability of stress-preventive interventions for persons at risk of developing stress-related health problems. The role of the world wide web (www), or internet, in increasing the availability of health-related information and intervention has been addressed by the Swedish government as a part of a vision for digitalization within the health care field. The vision states that Sweden will be the leading country within this domain, defined as eHealth Government Offices of Sweden, 2016).

The AAAQ framework directs that developers of interventions should consider the context of the user to increase acceptability. Integrating different research areas in an interdisciplinary project could enhance the quality of web-based programs. The availability of such programs together with enhanced accessibility could contribute to sustainable health and increased welfare.

## 1.2 Perspective on stress

The field of stress has generated a great amount of research during the last century. This research has focused on how stress can influence mental and physical health and on how to prevent its harmful consequences (Lovallo,

2016). Two major fields can be identified regarding the research on work-related stress: research on how to support the individual in coping with stressful events or periods (Lazarus & Folkman, 1984; Maricutoiu, Sava, & Butta, 2014) and research on an organizational level studying organizations' role in employees' psychosocial work environments and the effect of this role on their stress (Bakker & Demerouti, 2007; Karasek & Theorell, 1990; Siegrist, 1996).

From an evolutionary perspective, stress is seen as a reaction to a threatening stimulus, preparing the body for fight or flight. The fight-or-flight response was first described by Walter Cannon approximately 1915 (Campbell Quick & Spielberger, 1994). Hormones such as noradrenaline and cortisol trigger the blood to be redirected from the gastrointestinal area to the muscles, glycogen is released into the bloodstream to provide energy to the muscles, and oxygen demand increases, leading to heavier breathing (Jonsdottir & Folkow, 2013). At the same time, glycogen is released into the bloodstream to provide the cells with energy. These physical reactions were probably central to the survival of our species, mobilizing the energy and resources needed either to run away from the danger or to fight it. Most individuals today can identify these reactions, even though the threatening stimulus is of a kind from which one cannot run away, such as a heavy work load or worries in one's private life. People describe how an elevated heart rate and heavy breathing can occur even though the stressed physical reaction is not needed in a situation such as speaking aloud in a large group or thinking about worries at work; these are events that one may not be able to run away from and, thus, stress levels remain high. When stress levels are elevated to a moderate level for a longer period, with a constant release of stress hormones, stress becomes a threat to our health (Jonsdottir & Folkow, 2013).

The cognitive perspective on stress includes how individuals perceive an event as stressful or not. A cognitive and transactional perspective has been used in much of the research during the last several decades, integrating psychological processes into the interactional perspective, in which personal and situational variables affect stressors and outcomes (Lazarus & Folkman, 1984; Morrison & Bennett, 2016). Taking this perspective, stress is defined as “...*a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her well-being*” (Lazarus & Folkman, 1984, p. 19). This definition of stress is used in the current thesis.

### 1.3 Stress and health

According to the Public Health Agency of Sweden's annual health survey, 13 % of the employed persons in Sweden perceived themselves as stressed and 3 % as *very* stressed (Sweden's Public Health Agency, 2015). These numbers have remained constant for several years. Even if stress by itself is the

main cause for sick-listing (Sweden's Social Insurance Agency, 2015), stress is also associated with a number of other health-related problems that can, by themselves, lead to sick leave. Depression (OECD, 2013), cardiovascular disease (Nyberg et al., 2013), musculoskeletal pain (Bongers, de Winter, Kompier, & Hildebrandt, 1993; Linton & Halldén, 1998), impaired sleep (Åkerstedt, 2006; Åkerstedt et al., 2002), and lowered immune system (Segerstrom & Miller, 2004) have all been associated with stress. Work-related stressors have been described as including organizational factors, home-work interference, career development, factors related to the job itself, the individual's role in the organization and the individual's relationships at work (Cartwright & Cooper, 1997).

Providing tools for persons to learn how they can, on an individual level, strengthen their own resources and change their behaviour to better handle and tackle stress-related situations, as well as tools that describe how to better recover after a period of stress, can lower stress levels and decrease the risk of ill health. Supporting individual behaviour change can address different stress-related problems (physical, emotional, cognitive or sleep disturbances). In working life, the development of stress has been ascertained in several models. In the job demands-resources model (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), risk factors associated with job stress are classified into two categories: job demands and job resources. Physical, psychological, social, or organizational demands exceeding the individual's perceived resources to handle them leads to strain. Job resources can also be physical, psychological, social, or organizational factors that support the employees in achieving goals and reducing job demands and the associated costs (physiological or psychological), or factors that stimulate personal growth, learning, and development. Job resources are positively related to work engagement, while demands are positively related to strain (Bakker & Demerouti, 2007). The work environment has been recognized as changing in the Western countries (Jones, Burke, & Westman, 2013). When the traditional industries is replaced with jobs that are often characterized by demanding education, creativity and analytic competence (Bahgat, Segovis, & Nelson, 2016) the demands on the individuals may rise. Providing support from a web-based tool as a resource for individuals to develop adaptive strategies to handle stress and to learn about the necessity of recovery may positively affect work-related stress.

## 1.4 Theories and models for health-related behaviour change

In 1977, George Engels published the article *The need for a new medical model: a challenge for biomedicine* in *Science* (Engel, 1977). This article forms part of a paradigm shift in how to understand health and illness. This

perspective integrated psychosocial factors into the biomedical perspective to form the biopsychosocial model. Health and illness were seen not only as a result of biological factors but also as a result of psychological and social factors. Within this paradigm of understanding health and illness, behavioural medicine integrates psychosocial, behavioural and biomedical knowledge relevant for health and illness into prevention, ethology, diagnosis, treatment and rehabilitation (International Society of Behavioral Medicine, n.d.). A behavioural medicine approach implies that both behavioural factors and medical factors are central for understanding health and illness.

Stress management is considered as having to do with behaviour change. A behaviour is defined as what a person does or thinks, also referred to as overt and covert behaviours. In some definitions of behaviour, emotions are considered as behaviours. Emotions can also be considered as responses to what is thought (Baldwin & Baldwin, 2001).

Several biomedical theories, learning theories, and health psychology theories are relevant within the behavioural medicine approach regarding stress management, but regarding web-based stress management, four theories arise as more important: Social Cognitive Theory (SCT) (Bandura, 1989), the Theory of Reasoned Action and Theory of Planned Behaviour (TRA/TPB) (Madden, Ellen, & Ajzen, 1992), the Transtheoretical Model (TTM) and the Stages of Change (SoC) (Norcross, Krebs, & Prochaska, 2011; Prochaska, Redding, & Evers, 2008) have been used in successful web-based behaviour change interventions (Webb, Joseph, Yardley, & Michie, 2010). In addition, the Transactional Theory of Stress and Coping (TSC) (Folkman & Lazarus, 1988) was chosen due to the focus on stress and coping in this thesis.

### 1.4.1 Social Cognitive Theory (SCT)

The SCT links the individual, the behaviour and the environment in a reciprocal manner and can in this project be seen both as a theory for supporting behaviour change and as a theory for how stress is developed and maintained in individuals' everyday lives. Stress can be seen as deriving from the environment, the individual's resources or the influence of both on the behaviour in a certain situation (Bandura, 1989). To support behaviour, change several important concepts from SCT are central for this thesis: Reciprocal determinism between the individual, environment and behaviour; outcome expectations for current or new behaviour; self-efficacy in specific behaviour; observational learning and self-regulation, meaning the ability to tolerate short-term negative consequences if the person believes that positive long-term consequences are reachable. Methods to increase self-efficacy include mastery experience, social modelling and working to improve physical and emotional states before trying the behaviour (Ashford, Edmunds, & French, 2010; Bandura, 1982), in this case, handling a stressful situation.

## 1.4.2 The Theory of Reasoned Action and the Theory of Planned Behaviour (TRA/TPB)

Within the TRA (Madden et al., 1992), the most important determinant of new behaviour is stated as behavioural intention. Attitudes towards performing the behaviour and the subjective norm associated with the behaviour are also central. The TPB adds perceived control over behaviour as a central concept (Madden et al., 1992). Perceived control is a determinant for the behavioural intention, and attitudes towards the behaviour and the perceived subjective norm (Madden et al., 1992) are also important in changing behaviour. To increase perceived control over new behaviours to enhance health, difficult behaviours should preferably be successively graded from an easier level to a more complex level of performance.

## 1.4.3 The Transtheoretical Model (TTM) and the Stages of Change (SoC)

The TTM was developed by integrating processes and principles of change from major theories within psychotherapy and behaviour change (Prochaska et al., 2008). The TTM consists of Processes of Change, Decisional Balance and Self-Efficacy. The TTM and SoC provide interventions with the tools for behaviour change but also ways to tailor the interventions according to the user's readiness to change. The Transtheoretical Model and, more precisely, the Stages of Change (Horiuchi et al., 2010; Norcross et al., 2011; Prochaska et al., 2008) have often been used to tailor interventions for various behaviour changes, both web-based and face-to-face (Knittle, De Gucht, & Maes, 2012; Webb et al., 2010). The SoC consists of six stages: Precontemplation (no intention to take action within the next 6 months), contemplation (intends to take action within the next 6 months), preparation (intends to take action within the next month or has taken steps in this direction), action (action has been taken within 6 months), maintenance (action has continued for more than 6 months) and termination (no temptation to relapse) (Horiuchi et al., 2010; Norcross et al., 2011; Prochaska et al., 2008). There are ten processes of change related to the different stages (consciousness raising, dramatic relief, self-re-evaluation, environmental re-evaluation, self-liberation, helping relationships, counter-conditioning, reinforcement management, stimulus control and social liberation). Assessing the SoC to individualize an intervention increases the chance of providing adequate tools to support behaviour change appropriate for the specific individual by improving reasoning about decisional balance, increasing self-efficacy for change, and applying processes of change (such as increasing awareness, reinforcement, social support and environmental re-evaluation) related to the stages. Tailoring has been recognized as important in web-based interventions (Williams, Gatién, & Hagerty, 2011), and using the SoC as well as the processes of change related to the step identified as relevant

for an individual can be one way of tailoring a fully automated web-based intervention.

#### 1.4.4 The Transactional Model of Stress and Coping (TSC)

The TSC (Folkman & Lazarus, 1988) is a framework for evaluating how individuals cope with stressful situations. Coping is defined as “ongoing cognitive and behavioural efforts to manage specific external and/or internal demands (stressors) that are appraised as taxing or exceeding the resources of the person” (Lazarus, 1993), i.e., the process of managing the demands that an event appraised as stressful places upon the individual. Coping can be categorized into emotional- and problem-focused coping (Folkman & Lazarus, 1980; Folkman & Lazarus, 1991). The central concepts within the model are primary appraisal, or how the individual evaluates the situation as potentially harmful, threatening or challenging; and secondary appraisal, which includes the person’s ability to alter the situation by using available coping strategies, both adaptive and maladaptive. The coping efforts lead to outcomes of the coping process, e.g., well-being (Folkman & Lazarus, 1988). A web-based programme for stress management could target both primary and secondary appraisal by providing users with tools to support functional coping strategies for outcomes of improved or sustained health and well-being. Several stress-management strategies have their conceptual origin in this framework, for example, problem management, which includes strategies directed at changing a stressful situation with active coping, problem solving or information seeking, and emotional regulation, which involves changing the way one thinks/feels about a stressful situation (Folkman & Lazarus, 1988).

#### 1.4.5 Model for behaviour change in internet interventions

A model for describing how behaviour change is supported through internet intervention was developed by Ritterband, Thorndike, Cox, Kovatchev, and Gonder-Frederick (2009).

The model describes factors affecting the behaviour change. For example, website use and adherence depend on user characteristics and website characteristics. The degree of support also influences website use and website characteristics. Behaviour change is attained through various change mechanisms, leading to symptom improvement, which is sustained through treatment maintenance. Environmental factors affect the user, who in turn affects website use and adherence, behaviour change and symptom improvement. Website use is in turn influenced by support and website characteristics (Ritterband et al., 2009). In developing new internet interventions, it is important to use all available evidence for intervention content but also to include evidence regarding how to shape the platform from which the content is to be delivered.

## 1.5 eHealth

To this date, the most cited definition of eHealth is by Eysenbach (2001), defining eHealth as

*“... an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology.”*

This broad definition has been used to describe a broad range of digital technologies and interventions. Several related terms have also been used within the eHealth field, such as mHealth, referring to mobile applications, and telehealth and telecare, referring to, for example, video conversations and monitoring. A recent study presents an updated, operationalizable definition of eHealth (Shaw et al., 2017). Three domains describe the use of digital technologies 1) to monitor, track and inform; 2) to facilitate communicative encounters between health stakeholders; and 3) to use data to improve health and health services (Shaw et al., 2017). eHealth empowers users to take an active role in their health care through accessibility to eHealth programs/products. eHealth could also contribute to easier communication between users and professionals, caregivers or peers. One further possibility is how data can be stored, managed and analysed for decision support and increasingly personalized and precise health care (Shaw et al., 2017). Digital behaviour change interventions (DBCI) have been identified as an important aspect to improving health and wellbeing and could be considered as a specific sub-group within the eHealth area (West & Michie, 2016).

Today, 76 % of Swedes use the internet at least once a day, and for those 16-65 years old, the number is approximately 97 %. A significant proportion of this group (approximately 75 %) also considers the internet as important at work or for studies. The number is similar for those who consider the internet important in leisure time. Approximately 90 % of the Swedish population has access to a computer and internet and/or broadband service (Findahl & Davidsson, 2015).

A web-based application for supporting health-related behaviour change could therefore reach nearly the entire working-age population, and a fully automated programme could have unlimited users. Making a web-based application accessible to a large proportion of the population could therefore release in-person resources for other groups or for persons unlikely to be helped by a web-based application, thereby increasing more individuals' health and, by extension, their welfare.

Sweden aspires to take a leading role regarding eHealth possibilities and digitization within health care and social services and has adopted a vision regarding this:

“In 2025, Sweden will be best in the world at using the opportunities offered by digitization and eHealth to make it easier for people to achieve good and equal health and welfare, and to develop and strengthen their own resources for increased independence and participation in the life of society.” (Government Offices of Sweden, 2016)

The vision is that “digitization and eHealth will make it easier for people to achieve good health and welfare and strengthen resources for increased independence and participation in the life of society” (Government Offices of Sweden, 2016).

## 1.6 Web-based interventions for stress management

There are several web-based stress management programs available today, with systematic reviews and single studies showing significant effects on perceived stress (Allexandre et al., 2016; Billings, Cook, Hendrickson, & Dove, 2008; Carolan, Harris, & Cavanagh, 2017; Hasson, Anderberg, Theorell, & Arnetz, 2005; Heber et al., 2013; Ryan, Bergin, Chalder, & Wells, 2017; van Straten, Cuijpers, & Smits, 2008; Williams, Hagerty, Brasington, Clem, & Williams, 2010; Yamagishi et al., 2007; Zetterqvist, Maanmies, Ström, & Andersson, 2003). Nonetheless, several studies have methodological difficulties, such as no long-term follow up or no effect at long-term follow up (Yamagishi et al., 2007). Another web-based intervention consisting of mindfulness showed an effect on perceived stress and on other psychological factors related to job stress, both on short-term (8 weeks) and long-term (1 year) follow up, but the dropout rate was high (Allexandre et al., 2016). Other limitations in previous studies include issues such as the intervention group being measured more often than the comparison group (Van Vliet & Andrews, 2008), something that is common in evaluating web-based interventions and that could confound the positive results on stress (Jorm, 2009).

A two-session web-based intervention was compared to the same intervention led by an instructor in a workshop format and compared with a wait-list group. The intervention included progressive relaxation, time management and home-work assignments encouraging the practice of a variety of stress-management strategies (Pollak Eisen, Allen, Bollash, & Pescatello, 2008). The results did not show any long-term effects on stress in either of the two intervention groups but had a short-term positive effect on stress after practice in relaxation (Pollak Eisen et al., 2008). Despite methodological difficulties in a study of the effectiveness of a web-based stress-management programme



for junior-high school students, adherence was relatively high (69 %) (Van Vliet & Andrews, 2008). That program, which was adapted for students 14-18 years old, included various stress-management strategies, providing a holistic view on stress and stress management: psychoeducation on stress and lessons about coping, avoidance behaviour, problem solving, challenging unhelpful thoughts, and time management. It also included information on lifestyle changes such as physical activity and its effect on well-being. The study showed a significant increase in knowledge and support-seeking coping and a significant decrease in avoidant coping and total difficulties over time. There were also significant decreases in psychological distress and increases in well-being over the study period.

Several studies included only one or a few evidence-based stress-management strategies, such as assertion training (Yamagishi et al., 2007) or stress management based exclusively on a mindfulness approach (Allexandre et al., 2016) or cognitive-behavioural techniques (Billings et al., 2008). None of the programs in the searchers for stress management for work-related stress used a wider range of relevant stress-management techniques to manage the emotional, cognitive, physical and sleep-related symptoms of stress. Furthermore, the programs found in the literature search were seldom tailored to fit the individuals' own stress-related problems, even if some programs had been tailored to some extent. It has been expressed that future interventions need to be more tailored than existing interventions in order to reduce stress-related problems (Maricutoiu et al., 2014). Using one or only a few techniques for stress management could contribute to difficulties in tailoring a programme to fit users' needs. One meta-analysis (Webb et al., 2010) stated that successful web-based interventions to support health behaviour change were theory based, in most cases included several techniques for behaviour change, and could be delivered both as fully automated programs or as programs that provided contact with a therapist.

Adherence to web-based behaviour change programs is low in general, with a dropout rate of 50 % on average (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012), and web-based, self-management programs for stress management have shown the same numbers (Allexandre et al., 2016; Zetterqvist et al., 2003). In one study, dropout was high both for a computer-based intervention group and for the face-to-face intervention group but was significantly higher in the computer-based intervention group (Pollak Eisen et al., 2008). One study investigating factors associated with high use of a web-based stress-management programme found that interactivity was an important factor for determining participation (Hasson, Brown, & Hasson, 2010). Offering individualization and tailoring has also been suggested as key for successful web-based stress-management programs (Reily et al., 2011; Williams et al., 2011), as is offering a platform that is easy to use, visually attractive and appealing as well as accessible 24/7 (Williams et al., 2011). Simplicity, or what is found to be simple, varies among cultures (Mollerup,

2015). It also varies over time, depending on the designs used in present software that people use in their everyday lives (West & Michie, 2016). Nevertheless, simplicity is crucial for a successful program. It is also preferable to organize the content in modules to allow content flexibility and the ability to deliver content to users with various needs (Williams et al., 2011). Dividing the content into modules is common in programs directed towards mental health problems (Kelders et al., 2012). In addition, support from a real-life therapist or coach has been identified as supporting adherence to a programme (Kelders et al., 2012) but could be considered as more resource demanding.

Lack of tailoring, interactivity and issues concerning informational design could be acceptability aspects relevant to increasing programme adherence. Thus, a new web-based self-management programme for stress management should be individually tailored, interactive and structured in modules. It should also be based on a solid theoretical framework and include several behaviour change techniques. The platform must be easy to use and visually attractive and include several evidence-based stress-management strategies to meet the different needs of users.

## 2. Rationale

Stress is the main reason for sick leave in Sweden today. The costs to society, employers and, not least, the affected individuals are high. Furthermore, affected individuals can continue to suffer the long-term consequences of stress long after the original stressor is gone. This thesis focuses on how to deliver intervention in order to change behaviours related to stress and health and educate individuals in adaptive coping strategies to better cope with stress in order to maintain health. Educating individuals to cope with stress and to learn the necessity of recovery after stressful events or periods can influence the perception of stress. Stress-management programs are available today, both face-to-face and web-based. Some of the existing web-based programs have shown an effect on stress levels in different groups. Nevertheless, existing web-based programs for stress management in an occupational context are not often tailored or interactive, do not provide several evidence-based strategies for decreasing stress levels, do not focus on informational design, and do not include extended use of evidence-based behaviour change techniques. Existing programs also have problems with adherence, which could derive from lack of tailoring, interactivity and design. Studies with an interdisciplinary approach from fields such as health-related behaviour change, stress management and informational design could lead to the development of an effective program that is acceptable to users, thereby leading to decreased stress and lower dropout. Availability of a web-based program for stress management that is developed for persons still at work but with elevated stress levels may be helpful to prevent the stress that leads to ill health and sick leave.

Thus, there is a need for a new web-based program for stress management. This new program should be tailored, include several stress-management strategies of various types and have interactive components.

Developing a web-based program for stress management based on the evidence within multiple fields regarding behaviour change, stress management and informational design could contribute to a highly qualitative program with effects on health-related problems such as stress. Extensive evaluation of the program at several stages in the process can strengthen the evidence in the area and also contribute to increase health, and in the long run, also to the welfare.

### 3. Aims

The overall aim of this thesis was to develop and evaluate a fully automated, evidence-based web-application for stress management for persons experiencing work related stress.

- Study I To describe the systematic development of an evidence-based, tailored, interactive web application for the self-management of work-related stress. The aim was also to test the applications usability with respect to how to proceed through the program.
- Study II To investigate the feasibility of a web-based program that promotes behaviour change for stress related problems in terms of the program's acceptability, practicability, and any possible effects. In addition, the aim was also to study how appropriate and realistic the study's process and resource management would be for conducting a randomized controlled trial.
- Study III To explore users' experiences of using a tailored and interactive web application that supports behaviour change in stress management. The aim was also to identify if, and what, the web-based programme needed further development or adjustment so as to be feasible in a randomised controlled trial.
- Study IV To evaluate a web-based, self-management program regarding its effect on perceived stress in persons experiencing work related stress in a randomised controlled trial.

## 4. Methods

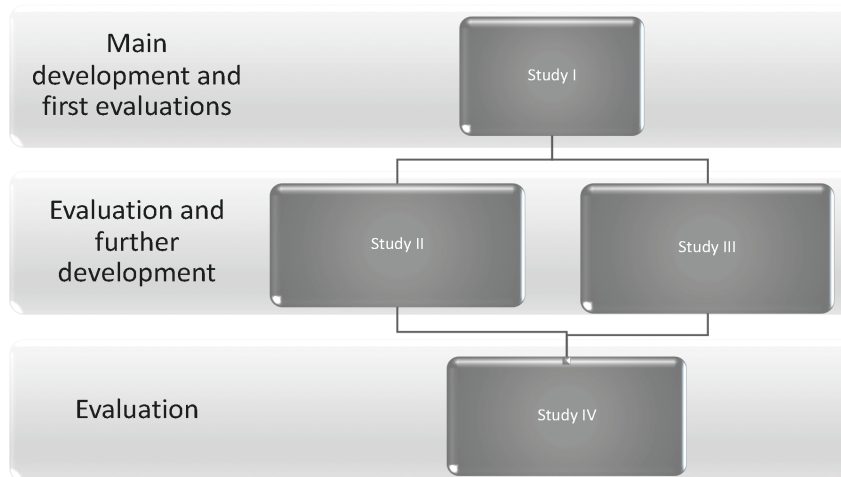
Quantitative, qualitative and mixed-method designs were used in this thesis. An overview of the design, participants, data collection and data analysis for all four studies is presented in Table 1.

Table 1. Overview of the study design, participants, data collection and analysis methods

<b>Study</b>	<b>Design</b>	<b>Participants</b>	<b>Data collection</b>	<b>Data analysis</b>
<b>I</b>	Exploratory, development process	4 experts, 15 possible end-users	State-of-the-art literature review, discussions (experts), observations (end-users)	Descriptive
<b>II</b>	One group, pre-post study	14	Questionnaires	Mixed methods: Inferential statistical analysis, content categorization
<b>III</b>	Explorative	9	Semi-structured interviews	Inductive content analysis
<b>IV</b>	RCT	92	Questionnaires	Descriptive and inferential statistical analysis

This thesis project consisted of three major blocks (see Figure 1). The first block considered the main part of the development of a web-based program in two phases. In block II, the first evaluations of the program were conducted. This block was also the basis for further development and preparation for a large-scale evaluation. In the third block, the second version of the program was evaluated in a large-scale study regarding its effect.

Figure 1. Design of the project



## 4.1 Settings and participants

The first three studies used a convenience sample consisting of participants recruited from a university in Sweden. Study IV was conducted in worksites within different sectors: two municipalities, one county council and one private company. The worksites for study IV were chosen to limit the number of gatekeepers, since these sites are among the biggest employers in the region. The study participants were the same in studies I, II and III, except for five participants who did not take part in study III. In addition, four experts and one possible end-user were included in study I but not in studies II and III. Inclusion and exclusion criteria were the same for all four studies, except for one added inclusion criterion for study III: “participated in the feasibility study (study II)”. Inclusion criteria were stress score, measured with the Perceived Stress Scale (Cohen, Kamark, & Mermelstein, 1983; Cohen & Williamson, 1988), of 17 or higher (Brinkborg, Michaneck, Hessel, & Berglund, 2011); employed; 18–65 years old; able to speak and understand the Swedish language; and consented to take part in the study. Exclusion criteria were that

individual was currently on sick leave and a score of 11 or more on either of the subscales of the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983). The HADS consists of 14 items on a 4-point scale (0-3) forming two subscales: one assessing anxiety and one assessing depression. Points can vary from 0-21 for each subscale, and a higher score indicates more distress. A score of 11 or higher on either of the subscales indicates the presence of a mood disorder (Bjelland, Dahl, Haug, & Neckelmann, 2002; Herrmann, 1997; Wilkinson & Barczak, 1988).

Fifteen individuals consented to take part in study I and study II (this does not include the one end-user who tested an early version of the program, or the four experts). One of the 15 individuals was excluded based on HADS results. The demographics of the study participants in study I (usability) and study II are presented in Table 2.

Nine women consented to participate in study III. The man from study II was not accessible when it was time to make an appointment for the interview despite several attempts to reach him (see Table 3 for description of the participants in study III).

In study IV, 244 persons signed informed consent forms and was allocated to either intervention or wait-list group. Eighty-five persons were lost before first assessment, and of the remaining persons 67 were excluded. Ninety-two persons were included and responded to the first assessments, and 31 persons responded to the final assessments. The demographics of the participants in study IV are described in Table 2. In study IV, there were no significant differences regarding demographic data and the primary outcome, perceived stress, in the intervention group between dropouts and those completing the final assessment.

Table 2. Demographic data of participants in study I (the usability test), study II and study IV, divided into an intervention group and wait-list group.

<b>Demographics</b>	<b>Medians, (range), frequencies and (%) study I and II (n=14)</b>	<b>Means, (sd), frequencies and (%) study IV in-tervention group at base-line (n=48)</b>	<b>Means, (sd), frequencies and (%) study IV wait-list group at baseline (n=44)</b>
Age (years)	44.5 (29-63)	45.9 (10.5)	40.5 (10.2)
Gender (female)	13 (93%)	42 (87.5%)	39 (88.6%)
<b>Marital status</b>			
Living alone	4 (29%)	6 (12.5%)	11 (25%)
Living with a partner	2 (14%)	15 (31.3%)	12 (27.3%)
Married	8 (57%)	27 (56.3%)	21(47.7%)
<b>Education</b>			
Compulsory school	0	1 (2.1%)	0
Upper secondary school	2 (14%)	8 (16.7%)	12 (27.3%)
Bachelor/University	7 (50%)	34 (70.8%)	26 (59.1%)
Master	4 (29%)	5 (10.4%)	6 (13.6%)
Doctor	1 (7%)	0	0
<b>Employment status</b>			
Permanent employed	12 (86%)	46 (95.8%)	42 (95.5%)
Temporary employment	2 (14%)	1 (2.1%)	2 (4.5%)
By hours	0	1 (2.1%)	0



Table 3. Demographics of study participants in study III

<b>Study participant</b>	<b>Age</b>	<b>Occupation</b>	<b>Stress level according to PSS-14</b>
1	54	Teaching staff	23
2	33	Teaching staff	27
3	29	Teaching staff	18
4	57	Administrative staff	17
5	40	Administrative staff	20
6	48	Administrative staff	32
7	34	Administrative staff	27
8	62	Administrative staff	22
9	56	Administrative staff	27

## 4.2 Procedure

The PhD-student (CE) visited three departments at the university and informed them about studies I, II and III. Both oral and written information included the aims of the studies, the voluntary nature of participation and that participation could be withdrawn at any time, how data would be stored, and the ethical considerations of participation. The information also included the overall content of the My Stress Control (MSC) program and estimated time for participation and using the program. Interested people signed informed consent for the studies. After finishing participation in study I and study II, the participants were then asked to take part in study III.

Study II was a feasibility investigation of the prospect of study IV, the randomized controlled trial (RCT), and therefore had the same procedure as the planned RCT except for the randomization procedure. In addition, in study II, the time-lock function in the program was removed. After informed consent, the study participants received log-in information as well as the first round of questionnaires at the e-mail address entered on the consent form. They were

advised to work with several stress-management strategies in parallel. Half-way through the program, the participants received a second round of questionnaires. The participants were informed of the deadline of the study and when the third round of questionnaires would be sent out. The participants had access to MSC for nine weeks. Reminders to send in questionnaires were sent one week after of each round of questionnaires.

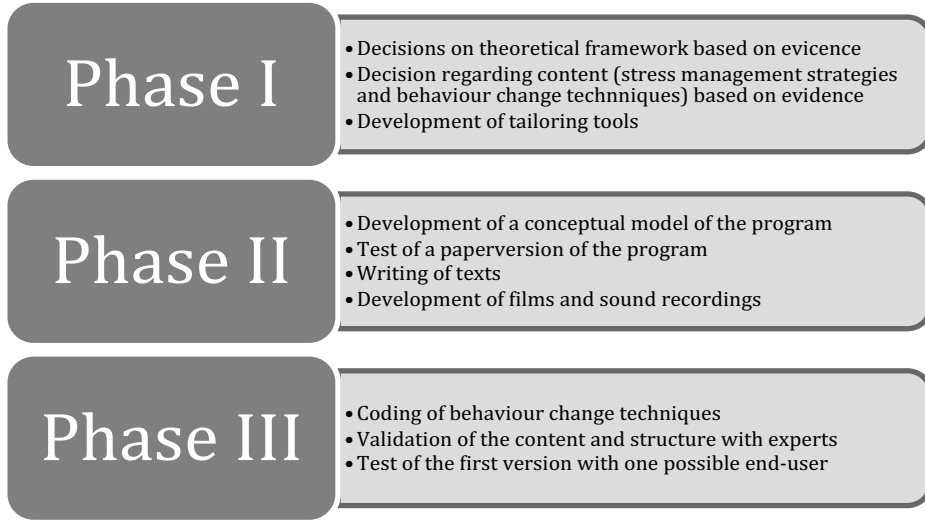
Regarding study IV, 28 different worksites were visited for recruiting purposes, and in some cases, 2 presentations were made at the same work site at different time points to inform as many employees as possible at each work site about the study. In most cases, the information about the study was presented at the regular work-site meetings for approximately 15 minutes. The study was presented in brief, and all interested persons also received written information. Informed consent could be handed in directly after the presentation, sent in individually or put in an envelope together with others to be sent in. The study participants were contacted by e-mail and received questionnaires and log-in information at the e-mail address provided on the informed consent form. Participants received access to the web-based programme after answering the first round of questionnaires. Exclusion procedures, which involved criteria regarding perceived stress measures with a score of lower than 17 on the PSS-14 and regarding depression and anxiety with a score of 11 or higher on either of the subscales on the HADS, were conducted post randomization by the time the participants logged on to the web-based programme for the first time.

## 4.3 Data collection

### Study I

The development of the web-based stress-management programme consisted of a total of three phases (see Figure 2). Data collection and analyses were mostly conducted step by step, resulting in one step serving as the presumption or base for the next step. Study I also contained a usability test that examined whether the participants reached the end of the program; if not, reasons for this incompleteness were investigated.

Figure 2. Development process of the web application



### **Phase I**

Based on earlier research, in phase I the aim was to identify and decide on content for the stress-management programme as well as to decide on a solid theoretical framework for the program. A state-of-the-art literature review (Grant & Booth, 2009) was conducted. Evidence regarding stress-management training, how to support behaviour change both through internet and face-to-face interventions, and evidence regarding the theoretical foundation were searched for. The search strategy was to identify prominent work in the different areas and, using key words as well as reference lists of found works, to further deepen the understanding of how the content for a fully automated behaviour change program for stress-related problems could be developed using evidence from multiple fields. Databases were searched using key words such as behaviour change, stress management, eHealth, internet and web-based in different combinations. Specific journals, e.g., the Journal of Stress Management and the Journal of Medical Internet Research, were searched for relevant papers.

Also in phase I, web-based assessment tools were developed in order to tailor the program to meet the individuals' specific needs for stress management. The evidence found in the searches also served as the base for how to tailor the program.

### **Phase II**

The aim for phase II was to develop a web-based platform suitable for placing the content developed in phase I and presenting it in a web-based format. The

aim was further to provide the platform with features that enhanced the probability of adherence to the program and enabled interactivity. The structure of the program was developed by first constructing a conceptual model for the program in order to overview the possible algorithms. Second, a paper prototype of the program was constructed. This paper prototype was tested within the research team to identify usability issues (Virzi, Sokolov, & Karis, 1996). Discussions with a web designer and an experienced programmer were also part of this development.

Text for information about the program and use of the program, assignments in the stress-management modules, the films/animations in all modules and audio recordings for films and audio-files were written. All texts, films/animations and audio recordings were reviewed from an informational design perspective by an expert within the field of informational design. A main focus for the information design was that the text be easy to read and that it avoid heteronormative stereotyping and reasserting stereotypes of stressed persons.

### **Phase III**

In the third phase, the program was presented to experts within the field in order to confirm the content and structure and tested with one possible end-user in order to identify usability problems. To clarify how and where the behaviour change techniques were incorporated and to enhance the transparency of the program, the behaviour change techniques were coded according to the Taxonomy for Behaviour Change Techniques (Abraham & Michie, 2008). The beta-version of the program's structure, content and progress was presented on two occasions to experts (four persons) within the area of occupational health and stress management in an occupational context.

The beta version was also tested by one possible end-user to identify problems with the advanced algorithms. During the test, the project leader (PhD student (CE)) was present and noted whether anything was difficult to understand or made use of the program more difficult. Bugs were identified and rectified.

### **Usability test**

As a final step, 14 possible end-users received access to the final version of the program in order to determine whether the end-users understood how to proceed through the program. See Table 2 for more information about the participants in study I.

The participants were instructed to proceed through the program at a rapid pace and not to work with the assignments for as long a time as stated in the assignments' instructions, which could be days or weeks. The study participants were followed using an administrative tool in the web application through which the first author could monitor to which parts of the program the participants had access.

## Study II

Two types of data were collected during the study. First, while the study participants were going through the program, e-mails communicating problems with the platform and program were collected. Bugs identified by the users were immediately rectified. The need for support while going through the program was reviewed. Second, data were collected using questionnaires before, during and after completion of the program. One of the questionnaires was developed to investigate the acceptability of the program (acceptability questionnaire). This questionnaire covered experiences with the content, tailoring, feedback, whether the participants managed to perform a functional behavioural analysis (FBA) with the program's support, goal setting, graphic and pedagogical design, and how the information was perceived. This information was collected with 13 statements about to what degree MSC fulfilled expectations regarding the areas above. There were also three yes/no response statements about the platform's usability, two questions about the time allowed for proceeding through the program, and four free-text fields for possible suggestions of changes to the platform and program.

The following questionnaires were used in study II: the Perceived Stress Scale (PSS) (Cohen et al., 1983) to assess frequency of stress-related thoughts and emotions; the Coping Self-efficacy Scale (CSS) (Chesney, Neilands, Chambers, Taylor, & Folkman, 2006) to measure perceived self-efficacy for coping with stressors; the Motivation for Change Questionnaire (MCQ) (Grahn & Gard, 2008) to measure motivation for change in life and work situations; the QPS Nordic 34+ (short version of the QPS Nordic) to measure psychological and social factors at work (Wännström, 2008); the Utrecht Work Engagement Scale (UWES), shortened version, to measure the person's engagement in his or her work (Schaufeli, Bakker, & Salanova, 2006); and a situational version of the Brief COPE Questionnaire (Carver, Scheier, & Weintraub, 1989) to measure 14 different coping strategies for coping in stressful situations. In addition, two four-item emotional-approach coping scales embedded in the Brief COPE (Stanton, Kirk, Cameron, & Danoff-Burg, 2000) were used. See Table 4 for an overview of time points regarding use of the different questionnaires and Table 7 for maximum and minimum scores for all scales and subscales included.

Table 4. Time point for use of each questionnaire in relation to use of the program in study II

<b>QUESTIONNAIRE</b>	<b>PRE</b>	<b>DURING</b>	<b>POST</b>
<b>PSS-14</b>	X	X	X
<b>CSS</b>	X	X	X
<b>MCQ</b>	X	X	
<b>QPS 34+</b>	X		X
<b>UWES</b>	X		X
<b>BRIEF COPE</b>	X		X
<b>ACCEPTABILITY QUESTIONNAIRE</b>			X

### Study III

In the third study, data were collected using semi-structured interviews with open-ended questions. The interviews were conducted by the PhD-student (CE). The interviews were held in a private room chosen by the study participants. The interviews were audio-recorded using a voice recorder and lasted between 21 and 40 minutes, for a total of approximately 4.5 hours. To elicit more detailed information than was given in the first answer and to steer the interviews towards the study's aim, probing questions followed the main questions (Polit and Beck, 2011).

An interview guide was developed for data collection (see Appendix). All interviews began by the interviewer prompting the participants to describe their situation and whether they perceive themselves as stressed and then continued with questions on how the participants worked with the program as a whole and with specific parts of the program, how they understood how to use the program, the program's tailoring and thoughts about working with a program for stress management (see also study III). Throughout the interview, the participants were encouraged to suggest changes and to critique the content and the program. Reflections from each interview were noted.

## Study IV

Questionnaires were used for data collection. The same questionnaires were used in study IV as in study II. For the primary outcome measure, the Perceived Stress Scale-14 (Cohen et al., 1983; Cohen & Williamson, 1988) in Swedish translation was used.

For secondary outcome measures, the following questionnaires were used: The Coping Self-efficacy Scale (CSS) (Chesney et al., 2006), the short version of the QPS Nordic measuring psychological and social factors at work (Dallner et al., 2000), the shortened version of the Utrecht Work Engagement Scale (UWES) (Schaufeli et al., 2006), and the situational version of the Brief COPE Questionnaire (Carver et al., 1989) with the two four-item emotional-approach coping scales embedded (Stanton et al., 2000). In addition, the Motivation for Change Questionnaire (MCQ) (Grahn & Gard, 2008) measuring motivation for change in life and work situations was used to study whether motivation to change could predict adherence to MSC.

Demographic data was collected, together with the baseline assessment, after randomization. Reminders were sent out after two and four weeks after the time point at which both the baseline assessment and the post-intervention assessment were sent out. See Table 5 for overview of time points regarding use of the different questionnaires and Table 7 for maximum and minimum scores for all scales and subscales included.

Table 5. Time point for use of each questionnaire in relation to use of the program in study IV

<b>QUESTIONNAIRE</b>	<b>PRE</b>	<b>POST</b>	<b>6 MONTHS FOL-LOW-UP</b>
<b>PSS-14 (PRIMARY OUTCOME MEASURE)</b>	X	X	X
<b>CSS</b>	X	X	X
<b>MCQ</b>	X		
<b>QPS 34+</b>	X	X	X
<b>UWES</b>	X	X	X
<b>BRIEF COPE</b>	X	X	X

## 4.4 Data analyses

### Study I

Departing from the evidence found in phase I regarding the content for the program, discussions within the research team led to the final decision on the theoretical framework and the content for the stress-management program. How to use the behaviour change techniques and stress-management strategies in a self-management and web-based format was also discussed and how to incorporate them was decided.

For the decision regarding tailoring, the four authors of the study worked independently to connect the stress-management strategies to symptoms of stress.

In phase II, discussions within the research team with the designer and the programmer served as the basis for choosing the final graphics, colours and font. A professional designer created the four most central films/animations for the platform. Those were the films/animations most likely to be seen by all participants. All films and animations followed the same graphical, colour and font style.

The experts participating in phase III were asked if something was missing and if the structure of the program was relevant. The comments from the experts were categorized into two categories: relevant or not relevant. Notes taken from following the one possible end-user going through the program were used to identify problematic areas in program navigation. How far the participants progressed in the program was tracked and noted.

### Study II

The e-mail correspondence and information provided from the users' comments in the acceptability questionnaire were categorized. Since the comments were very short, it was decided that it was unnecessary to work with meaning units or condensation and the comments were directly categorized.

Descriptive statistics were used for the demographic data as well as the questionnaires regarding acceptability items. Inferential statistics were used to describe the possible pre-post intervention changes. Bonferroni correction was used in the effect analyses. There were four missing items from three different persons in the questionnaires. These items were replaced using the mean for the individual's score on the scale or subscale. Two of the process questionnaires (PSS and CSS) were not filled in at all by one participant.



## Study III

After the interview, the sound recordings from the interviews were transcribed verbatim. The text was read several times in order to obtain a sense of what the participants were talking about. The interviews were analysed using qualitative content analysis according to Graneheim and Lundman (2004). Meaning units—words, sentences or paragraphs that related to the aim—were highlighted in the text and condensed in order to reduce the quantity of the text. The condensed meaning units were coded. Three of the authors of study III worked with the same parts of the text individually on several occasions, comparing the coding and discussing the sorting of codes into sub-categories and categories in order to reach a consensus among the three authors. The rest of the data were then analysed by the PhD-student (CE), who sorted the codes into the developed sub-categories and categories if possible or developed new categories when needed. The tentative sub-categories and categories of the analysis were presented and discussed with the other authors on several occasions as the analysis proceeded. The final sub-categories and categories were critically scrutinized by the research team leading the formulation of the final theme.

## Study IV

Statistical analyses were carried out using SPSS 24 (Statistical Package for the Social Sciences, version 24 (IBM Corp, 1989, 2016)). Significance level was set to  $p < 0.05$ .

Demographic data were presented with descriptive statistics. For numeric demographic data and perceived stress scale, Student's *t*-test was used to detect differences reported at baseline between the intervention and wait-list groups. Student's *t*-test was also used to determine differences between and within the intervention and wait-list groups regarding PSS-14. Chi-square and Fisher's exact test were conducted in order to detect changes between the intervention and wait-list groups regarding demographic categorical data.

The outcome analyses were conducted according to intention to treat (ITT), and Cohen's *d* ( $d_{Cohen}$ ) was calculated based on means and standard deviations (Lenhard & Lenhard, 2016) for PSS-14.

The data for the primary outcome measured with PSS-14 was controlled for data quality and was normally distributed without any outliers.

For secondary outcome measures, the Wilcoxon signed rank test was used for calculating within-group changes, and the Mann-Whitney *U* test was used for between-group differences at baseline and for between-group changes at post-intervention assessment.

## 4.5 Ethical considerations

The ethical application (Dnr 2015/555) was approved on 2016-01-20 by the Ethics Committee in Uppsala County, Sweden. Additionally, an amended application was approved regarding study IV on 2016-01-20.

The participants in the studies were not expected to suffer any harm, either physically or psychologically, by participating. Only the researchers had access to the responses and the progress in the web-based program as well as the data collected from interviews and questionnaires. Information provided by the study participants was handled with confidentiality, and only one researcher knew what log-in was connected to which study participant. The same log-in id was used for questionnaires. There was a risk that participants experiencing high stress could perceive more stress by going through the program. Persons who experienced the program as overwhelming were not expected to continue to use MSC. Only workplaces with access to occupational health care and the usual insurance for employees were included. The participants were informed both orally and in writing that their participation was voluntary and that at any point they could cancel their participation without further justification. In studies II and IV, the study participants were offered the opportunity to complete the program without any more data being collected if they wanted to rescind their participation. Regarding self-management within the area of mental health it is also important to use appropriate psychosocial risk assessment instruments to identify individuals in at-risk groups with problems not appropriate for self-management programs. For this reason the Hospital Anxiety and Depression Scale (HADS) (Bjelland et al., 2002; Zigmond & Snaith, 1983) was used in MSC to avoid the inclusion of individuals who may need other support.

When conducting research within the mental health field, ethical issues must continuously be reflected upon through every stage of the research process, as was performed in this project. The role of the researcher, the security of the web-based program to ensure user confidentiality, the content of the program and the necessity of ensuring that user characteristics are appropriate for self-management of mental health-related problems are all ethical issues that were considered during the development of MSC and during the evaluation studies.

## 5. Results

### 5.1 From an idea to a ready to use product

The main result in study I was the web-based program called My Stress Control (MSC) (see Appendix). The theoretical framework for MSC includes SCT, TRA/TPB, TTM and SoC and TSC. The SCT, TRA/TPB and TTM and SoC are theories used in earlier web-based behaviour-change programs, and the TSC is a theory more specific to understanding and designing interventions in a stress-related context. MSC includes several techniques for supporting behaviour change, but five techniques are central: prompting intention to change, self-monitoring, goal-setting, reevaluation of goals and providing feedback. MSC is interactive and offers online exercises, questionnaires, and action planning, as well as assignments to complete between log-ins. Regarding the tailoring tool for the users' unique stress-related problems, the 32-item Symptoms of Stress Survey (SySS) was developed for MSC. The Calgary Symptoms of Stress Inventory (Carlson & Thomas, 2007), the Karolinska Sleep Questionnaire (Nordin, Åkerstedt, & Nordin, 2013), and the Perceived Stress Scale (Cohen et al., 1983) informed the tailoring. Consensus within the research group was reached in choosing certain stress-management strategies for the respective symptoms in the SySS. The program is tailored in two ways. First, the tailoring is based on the FBA conducted by the users supported by the program. Based on the SySS, MSC will present different stress-management strategies depending on the symptoms of stress connected to the situation described in the FBA. Second, tailoring is performed by examining a stage of change for each stress-management strategy, providing those "not ready for change" with an ambivalence module where pros and cons can be listed. Information is delivered in several ways and can be changed according to user preference. All information is available in text. Fourteen films/animations were also provided as an alternative source of information where the length of text was long.

The screening module includes the PSS-14 (0-56) and the Hospital Anxiety and Depression Scale (HADS). Screening is only conducted the first time a new user logs in. For access, the score on PSS-14 must be minimum of 17. The cut-off score is based on a similar population mean, minus one standard deviation (Brinkborg et al., 2011).

In an introduction to the My Stress Control program, information about how to navigate the platform, a rationale for the program and estimated time

to complete the program is presented. The tailoring tool appears for the first time at this stage, providing an overview of symptoms related to stress.

The first stress-management module is the psychoeducation module. It includes information about what stress is, symptoms of stress, and what can be done to handle stress on an individual level but also what role the environment plays in developing stress. The psychoeducation continues with education on behavioural analysis according to an ABC model (Antecedents, Behaviour, Consequences), in which the users are prompted to describe one situation where they experience stress. Depending on which symptoms in the SySS are connected to this situation, different stress-management strategies are suggested. Included stress-management strategies are pleasant activity scheduling, assertiveness training, relaxation, practice in changing negative thinking, and time management. All strategies follow a similar pattern, starting with a rationale for the module, goal-setting and planning for the rehearsal of the strategy, and exercises assigned depending on the strategy. Self-monitoring is central in the stress-management modules. The SySS appears at the end of each strategy and provides feedback on how the stress symptoms are changing over time.

An ambivalence module is provided for those stating that they are not ready to begin a stress-management strategy. This module includes information on the damaging effects of stress on one's own health and a pros-and-cons exercise.

Two modules related to lifestyle changes will appear after users complete the recommended stress-management strategies. Lifestyle changes associated with stress are mainly physical (in)activity and sleeping habits. All users are given access to the physical activity module. Those who have signs of sleep disturbances according to the SySS will be recommended the module for sleep improvement, including education in good sleep habits, sleep restriction, and sleep hygiene.

The last module includes information about maintaining good habits. An assignment to write a summary of the helpful activities in the program is provided for keeping if stress-related problems appear again in the future. The maintenance module includes formulation of long-term goals and includes information about the importance of social support through problem solving and establishing a behavioural contract with someone who can provide social support.

The experts were satisfied with the content and structure of MSC. The usability test with the 14 users showed that users encountered difficulty in understanding how to reach the final modules.

### 5.1.1 Assessing feasibility

The main findings from study II concerned the acceptability and practicability of My Stress Control. The feedback received via e-mail, verbal comments and the free-text questionnaire responses regarding acceptability were categorized into seven categories: Time, Extensiveness, Interference, Clarity, Flexibility, Insights, and Need for Reminders.

Time was associated with comments that the program was time-consuming and that it demanded too much time. The program was also perceived as extensive, and there were comments that there were too many materials to be filled in and that exercises were too long. Some factors were identified as interfering with the use of the platform. One major bug was detected, two audio-recordings had low quality and how YouTube suggested other films after participants watched those included in the program was perceived as confusing. The study participants also identified some parts of the program that required clarification. These ranged from misspellings to how to navigate and progress in the platform. Flexibility issues were also often mentioned by the users. One concrete suggestion was to develop a smartphone application to facilitate use of the web application. Insights included that participants had learned what stress is for them, how to prevent stress and how to plan for recovery. The need for reminders to log in to the platform was another factor that could be addressed to facilitate participants logging in to the platform.

Acceptability was assessed using the questionnaire developed for this purpose, with a cut-off score for acceptability of 5 or higher (0-10). MSC was considered as acceptable regarding ease of navigation and how the tailoring was performed. Participants' perception of the possibility of formulating an ABC model and their ability to understand the information provided by the program and the assignments received the highest scores. The examples and images provided were perceived as appropriate, and the participants were able to identify themselves in the images and examples. Items regarding whether the ABC model was returned to and further utilized during the use of the program, goal-setting, the pop-up feedback, and the last modules about maintenance and social support had the lowest scores. Only three persons visited the ambivalence module, which also received a low score regarding how it was perceived as a support in starting a technique that the participants had indicated they were not ready to start according to the SoC.

Eight persons completed both pre- and post-intervention measures. Regarding the effects of MSC, there were no significant changes in any of the variables presented in Table 6.

The study participants did not require much support. There were some difficulties in identifying the most appropriate time at which to send out the process measures, since the study participants worked at different paces. This

factor led to the development of the administrative tool for MSC and an overview function, which made it possible to easily view the study participants' progress in the program.

One of the three process measures, the MCQ, was stable during pre- and process time-points, and it was decided that the MCQ was not relevant as a process measure in the upcoming RCT.

Table 6. Differences between pre-and post-measures ( $n = 8$ ) (study II)

<b>Variables</b>	<b><i>p</i>-value</b>
Perceived Stress Scale -14	0.21
Coping Self-Efficacy Scale	0.16
Utrecht work engagement scale total	0.73
vigor	0.73
dedication	0.87
absorption	0.72
Brief COPE Questionnaire	
self-distraction	0.34
active coping	0.08
denial	1.00
substance use	1.00
use of emotional support	0.08
use of instrumental support	0.24
behavioral disengagement	0.08
venting	0.28
positive reframing	0.79
planning	0.08
humor	0.22
acceptance	0.03
religion	0.32
self-blame	1.00
coping through emotional processing	0.75
coping through emotional expression	0.59
QPS-Nordic 34+	
quantitative demands	0.18
demands on learning	0.13
role clarity	0.66
role conflicts	0.26
positive challenges at work	1.00
control over decisions	0.53
control over working pace	1.00
predictability over next month	0.56
predictability (single item)	0.56
experience of mastery	1.00
support from employer	0.78
support from colleagues	0.71

Variables	p-value
support from friends and family	0.10
social interaction (single item)	0.26
encouraging leadership	0.46
social climate	0.20
innovative climate	0.38
inequality	0.46
personnel targets	0.67
organizational culture and climate (single item)	0.06
teamwork	0.32
work satisfaction	0.16
stress (single item)	0.48

### 5.1.2 Struggles and paradoxes as user experiences

The third study resulted in two categories forming one theme: Struggling with what I need when stress management is about me. The first category, *Defining the needs*, contained four sub-categories: time—a paradox in stress training; adequate presentation for a stressed person; a relevant program; and make stress management happen in my reality. The second category, *It is about me*, also contained four sub-categories: taking departure from me; a program that understands what I need; perceived gains; and possibilities of choices and structure. The users struggled with what they needed: taking time to work with the program while already stressed. Although it was implied that for a self-management program to work, it needed to include a lot of information, the program still felt extensive to participants and, again, felt as though it took too much time and presented too much information at first sight. A web application supporting stress management was expressed as making stress management available for more people since there is no demand for attending at a certain time or place. Although difficulties and paradoxes were experienced during use of the program, the need for a program like MSC, focusing on the individual, taking as its point of departure the individuals' unique needs for stress management and focusing on how to handle stress and take responsibility of one's own stress, was something desirable. The program was experienced as possible to tailor to fit the users, and the users expressed that they had gained insights after having used the program. But to be forced into a fixed structure was perceived as something negative.

### 5.1.3 Further development

After analysing the results from the first three studies, further development was conducted regarding MSC and also regarding the study process. The main problems with the application were that the users did not understand how to reach the final module and that they found the program extensive. Regarding

the study process, the process measures were excluded in study IV, mainly because it was difficult to estimate time-points for sending out process measures since the participants worked at very different paces and had access to different numbers of modules depending on the tailoring.

The changes to the MSC program in response to the findings in study I, II and III were as follows:

- A new film was developed, describing the structure of the application in more detail and providing a map of the modules.
- The lifestyle modules (sleep and physical activity) appeared at the same time as the other stress-management strategies.
- Assignments were condensed in order to shorten the assignment list for each module.
- The social support and maintenance module was moved to appear before the summing-up module.
- Regarding the fixed structure, the time-lock feature that had been developed was not activated for study IV and was therefore never used.
- An administrative tool was developed.
- The presentation of MSC within the program was changed. The change mainly attempted to encourage persons to use parts of the program that were perceived as relevant and not to quit if they came across assignments they did not want to perform.

The administrative tool was further developed in order to more easily track the study participants as they proceeded through the program and to handle their profiles if they encountered problems.

## 5.2 Effects on stress of My Stress Control program

There were no significant differences either between or within groups regarding changes of the primary outcome, perceived stress, measured with PSS-14. Regarding the follow-up measures, only one person answered the follow-up questionnaires, resulting in no analyses being conducted on that data.

A small effect size (Cohen's  $d$ ) was shown between the intervention group and wait-list group regarding differences in mean change from baseline to post-assessment,  $d = 0.25$ . A small effect size was also shown within both the intervention group and the wait-list group ( $d = 0.38$  within the intervention group and  $d = 0.25$  within the wait-list group).

Two significant changes for between-group changes were detected. These changes considered the subscale coping through emotional processing ( $Z = -2.3$ ,  $p = 0.02$ ) on the Brief COPE questionnaire and predictability ( $U = 46.5$ ,  $p = 0.03$ ) in QPS. Further regarding the secondary outcomes, significance within the intervention group changes was found on one of the subscales of



the Brief COPE questionnaire, self-blame being significantly lower at post-assessment ( $Z = 2.06, p = 0.04$ ) and in two of the subscales on QPS, role conflict being significantly higher at post-assessment ( $Z = 2.06, p = 0.04$ ) and stress being significantly lower ( $Z = 2.43, p = 0.02$ ). Table 7 shows the medians and ranges for pre- and post-assessments for the primary and secondary outcome measures in the intervention and wait-list groups. In the wait-list group, role conflict was also higher at post-assessment ( $Z = 2.39, p = 0.02$ ), and scores for social interaction were lower ( $Z = -2.12, p = 0.03$ ).

Table 7. Medians and range for pre- and post-measures for completers in the intervention group ( $n = 12$ ) and in the wait-list group ( $n = 19$ ) (study IV)

Variables (min-max)	Intervention group (completers)		Wait-list (completers)	
	Pre	Post	Pre	Post
	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)
<b>Perceived Stress Scale -14 (0-56)</b>	$n = 12$ 24 (20.5:28.3)	$n = 12$ 19.5 (15.8:25:8)	$n = 19$ 22 (20:28)	$n = 19$ 22 (19:27)
<b>Coping Self-Efficacy Scale (0-260)</b>	$n = 12$ 158.5 (111.3:179)	$n = 11$ 175 (119:197)	$n = 19$ 146 (119:171)	$n = 18$ 154 (134.8:175)
<b>Utrecht work engagement scale (0-6 for total/each sub scale)</b>	$n = 11$ 4.3 (4.1:4.8)	$n = 11$ 4.7 (3.9:4.9)	$n = 19$ 4.7 (4.2:5.2)	$n = 17$ 4.9 (4.6:5.3)
- <b>vigor</b>	4.3 (4:4.7)	4.7 (3.3:5)	4.7 (4:5.3)	5 (4.7:5.2)
- <b>dedication</b>	4.7 (4:5)	4.7 (4:5)	5 (4.3:5.7)	5.3 (4.3:5.7)
- <b>absorption</b>	4.3 (4:5)	4.7 (4:5)	4.7 (4:5)	5 (4.3:5.3)
<b>Brief COPE Questionnaire</b>	$n = 11$	$n = 11$	$n = 19$	$n = 16$
- <b>self-distraction (2-8)</b>	5 (4:6)	4 (3:5)	5 (4:6)	5 (4:5.8)
- <b>problem focused coping (4-16)</b>	11 (10:13)	11 (10:12)	12 (10:13)	11 (10:12.8)
- <b>avoidant coping (6-24)</b>	9 (7:10)	7 (6:10)	9 (7:9)	8 (7:9.8)
- <b>socially supported coping (6-24)</b>	15 (12:17)	14 (11:16)	15 (13:17)	14.5 (11:19)
- <b>emotional focused coping (8-32)</b>	19 (17:20)	18 (16:21)	19 (15:21)	20 (16.3:21.8)
- <b>self-blame (2-8)</b>	5 (4:6)	4 (3:5)	4 (3:6)	4 (4:5.8)
- <b>coping through emotional processing (1-4)</b>	3 (2.5:3.3)	3 (2:3)	2.5 (2:2.8)	2.8 (2.1:3)

Variables (min-max)	Intervention group (completers)		Wait-list (completers)	
	Pre	Post	Pre	Post
	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)
- coping through emotional expression (1-4)	2.5 (2:2.8)	2.5 (2.3:3)	2.3 (2:2.7)	2.3 (2:2.9)
<b>QPS-Nordic 34+ (1-5 for each sub scale)</b>	<i>n</i> = 11	<i>n</i> = 11	<i>n</i> = 19	<i>n</i> = 16
- quantitative demands	4 (3:4)	4 (3:4.5)	3.5 (3:4.5)	3.5 (2.6:4)
- demands on learning	2 (1.5:2.5)	2 (2:3)	2 (1:2.5)	1.8 (1.5:3)
- role clarity	4 (3:4.5)	4 (3.5:5)	4 (4:5)	4.5 (3.6:4.9)
- role conflicts (single item)	2 (1:2)	2 (2:4)	1 (1:2)	2 (1.3:3.8)
- positive challenges at work	4 (4:4.5)	4.5 (4:4.5)	4.5 (4:5)	4.5 (4:5)
- control over decisions	3 (2.5:3)	3 (2.5: 3)	2.5 (2:3)	3 (2.6:3.5)
- control over working pace	3 (3:3.5)	3.5 (3:3.5)	3.5 (3:4.5)	3 (2.1:4.4)
- predictability over next month (single item)	4 (2:5)	3 (2:4)	4 (1:5)	4 (2:5)
- predictability (single item)	3 (2:4)	4 (2:4)	3 (1:3)	2.5 (2:3)
- experience of mastery (single item)	4 (4:4)	4 (4:5)	4 (4:5)	4 (4:5)
- support from employer	3.5 (3.5:4.5)	4 (3:4)	4 (3:4.5)	3.8 (3.5:4.5)
- support from colleagues (single item)	5 (4:5)	4 (4:5)	4 (4:5)	4 (4:5)
- support from friends and family (single item)	4 (3:4)	4 (3:5)	4 (3:4)	4 (3:4)
- social interaction (single item)	3 (2:3)	3 (2:4)	2 (2:4)	3 (2:3)
- encouraging leadership	3.5 (3:4.5)	3.5 (3:4)	3.5 (2.5:4)	3.5 (3.1:4)
- social climate	4 (4:4)	4 (3.5:4)	4 (4:4.5)	4.5 (3.6:4.9)
- innovative climate	4 (3.5:4.5)	3.5 (3.5:4.5)	4 (3:4)	4 (3.5:4.5)
- inequality	1 (1:2)	1 (1:2)	1 (1:2)	1.5 (1:2)

Variables (min-max)	Intervention group (completers)		Wait-list (completers)	
	Pre	Post	Pre	Post
	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)	Median (IRQ, 25 <sup>th</sup> percentile: 75 <sup>th</sup> percentile)
- <b>personnel targets</b>	3 (2.5:4)	2.5 (2:4)	3 (2.5:3.5)	3 (2.5:3.5)
- <b>organizational culture and climate (single item)</b>	4 (3:4)	3 (2:4)	4 (3:4)	4 (3:4)
- <b>teamwork</b>	4.5 (4:4.5)	4.5 (4:4.5)	4.5 (4:5)	4.5 (4: 4.5)
- <b>work satisfaction</b>	3 (2.5:4)	3.5 (2.5:4)	4 (3.5:4)	3.5 (3:4)
- <b>stress (single item)</b>	3 (3:4)	2 (2:3)	4 (3:4)	3.5 (3:4)
<b>Motivation to Change Questionnaire (1-4)</b>	<i>n</i> = 11	NA	<i>n</i> = 18	NA
- <b>social support in life</b>	3 (3:3.5)	NA	3 (2.9:3)	NA
- <b>control in life</b>	3 (3:3)	NA	3 (3:3)	NA
- <b>mastery in life</b>	3 (3:3)	NA	3 (3:3)	NA
- <b>challenges in life</b>	3 (3:3.5)	NA	3 (3:3)	NA
- <b>values</b>	3 (2:3)	NA	3 (2:3)	NA
- <b>self-efficacy</b>	4 (3:4)	NA	3 (3:4)	NA
- <b>self-confidence</b>	4 (3:4)	NA	3 (3:4)	NA
- <b>co-worker support</b>	3 (3:3)	NA	3 (3:4)	NA
- <b>supervisory support</b>	3 (2:3)	NA	3 (2:3)	NA
- <b>challenges in work</b>	3.5 (3:4)	NA	3.5 (3:3.6)	NA
- <b>job control</b>	3 (3:3)	NA	3 (2.8:3)	NA
- <b>goals</b>	3.5 (3:4)	NA	3.5 (3:3.6)	NA

Completers were defined as persons answering pre- and post-assessments for the primary outcome measure (PSS-14) in the intervention group or corresponding assessments in the wait-list group. In the intervention group, 12 persons (25 % of the participants) were defined as completers, while 19 (43 % of the participants) were completers in the wait-list group, for a total of 34 % in both groups who completed the second assessment. In most cases, dropout

reasons were not provided but, in the intervention group, an early technical issue with MSC led to the dropout of a handful of individuals.

The analyses showed no differences between dropouts and completers in demographic data at baseline except for one variable in the wait-list group regarding sector of employment. The dropouts in the intervention group had higher stress ( $t = 2.02, p = 0.049$ ) and lower self-efficacy ( $U = 110.5, p = 0.02$ ) and reported lower support from colleagues ( $U = 97.5, p = 0.02$ ), lower scores for social climate ( $U = 108.5, p < 0.05$ ) and teamwork ( $U = 68.5, p < 0.00$ ) at baseline compared to the completers in the intervention group. Additionally, the completers in the intervention group reported higher use of emotional processing ( $U = 77.5, p = 0.01$ ) than the dropouts.

In the wait-list group, dropouts reported lower work engagement than the completers on all the subscales in UWES, vigor ( $U = 65, p < 0.00$ ), dedication ( $U = 95, p = 0.01$ ) and absorption ( $U = 74.5, p < 0.00$ ), as well as on the total scale ( $U = 67, p < 0.00$ ). They also reported lower role clarity ( $U = 98, p = 0.03$ ) and lower predictability ( $U = 87, p = 0.01$ ), experience of mastery ( $U = 99.5, p = 0.02$ ), social climate ( $U = 100, p = 0.03$ ), innovative climate ( $U = 98, p = 0.02$ ), teamwork ( $U = 78, p = 0.00$ ) and work satisfaction ( $U = 85.5, p = 0.01$ ) and higher role conflict ( $U = 31, p < 0.00$ ) in comparison to completers in the wait-list group.

## 6. Discussion

### 6.1 Summary of results

This thesis focuses on how to take the idea of a web-based intervention to a ready-to-use and time-effective stress-management intervention. The main development was conducted in study I. The systematic development in the first two phases in study I led to a web application, My Stress Control (MSC). Three research fields were integrated during the development process: stress management, health-related behaviour change and informational design. The integration of these three fields during the development aimed at providing a holistic framework for developing a program for behaviour change and stress management. The information in MSC was presented based on principles within informational design and gender studies in order to offer an available, accessible, acceptable program of good quality. In lifestyle-related interventions, tunnelling (how the program is built in order to provide a pre-set path through the program), tailoring, self-monitoring and rehearsal are often used (Kelders et al., 2012). Web-based programs in the mental health field, on the other hand, are often set up in modules and unlocked in a certain order as the user proceeds through the program (Kelders et al., 2012). MSC could be considered as a hybrid between those two models which could be seen as mirroring how MSC is a health promotion program containing lifestyle related changes, but also concerning a mental health issue. MSC is structured in modules, but the program also has a tunnelling layout within the modules in order to steer the users to perform assignments, assessments and films in order, so that the participants follow a logical structure.

The first study also contained the first evaluations of MSC. The program test led to clarifications in MSC regarding navigation. However, the problem with the navigation was not only because of problems with navigation. The results in studies II and III revealed that the program was perceived as extensive. The study process, evaluated in study II, was considered as feasible to be conducted in a randomized controlled trial. Some minor changes were conducted regarding the study process: it was decided not to use the process measures in the future trial, and the questionnaires were transformed into a web-based format. The result in study III was the emergence of a primary theme: Struggling with what I need when stress management is about me. The paradox of working with a stress-management program as extensive as MSC when already stressed may contribute to higher stress levels. The theme about

struggling with what one needs when handling stress on an individual level also aligns with some results in study IV, where role conflict was significantly higher among the study participants in the intervention group. In the randomized controlled trial, study IV, the results showed no significant differences on the primary outcome, perceived stress, but did reveal a small effect size for the between-group stress measure regarding mean change over time and regarding the effect from pre- to post assessment within the intervention group. However, there was also a small effect size within the wait-list group. The dropout rate from study IV was high, with only 25 % completing the post assessment in the intervention group. The dropout analysis revealed that, compared to the completers, the dropouts from the intervention group had significantly higher stress and a more exposed psychosocial work situation with lower support from colleagues, lower social climate and lower scores regarding teamwork, while the completers had higher self-efficacy and reported higher use of emotional processing.

## 6.2 Development and testing: an iterative process

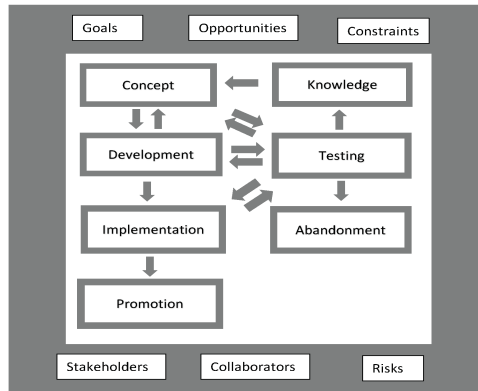
The design of the project was conducted in line with how currently is suggested for development and evaluation projects by leading researchers within the field of developing and evaluating digital behaviour change interventions in health care (West & Michie, 2016) and was reported as suggested by existing guidelines (Proudfoot et al., 2011). It is tempting to plan a project as a straight line from development to a full-scale evaluation (an RCT); however, development of complex interventions is often circular, as described in the Medical Research Council Guidance for developing and evaluating complex interventions (Craig et al., 2008). This circular process has been specified for developing Digital Behaviour Change Interventions (DBCI) and is described as more of an iterative process (West & Michie, 2016) (see Figure 3). The guidance by Craig et al. (2008) provides a broad framework and includes establishing a theoretical underpinning, development, and piloting before conducting a full-scale evaluation. The theoretical underpinning, consisting of theories used in earlier successful programs in which SCT (Bandura, 1989), TTM and SoC (Knittle et al., 2012; Prochaska et al., 2008), TRA/TPB (Madden et al., 1992) and TSC (Lazarus & Folkman, 1984) constituted a framework for web-based behaviour change intervention in the context of stress, was developed in study I. MSC was developed, to a large extent, in study I before the usability test in study I and the pilot evaluation in study II. However, regarding web-based programs supporting behaviour change, not only should effectiveness evaluations be conducted, acceptability should also be assessed (West & Michie, 2016), which was performed first in study II and then on a deeper level in study III, the qualitative study.

Implementation of web-based programs supporting behaviour change is often conducted before full-scale effect evaluations since the context and technology is changing so fast (West & Michie, 2016). Implementation should be considered from the start of the developing process, and also, of a DBCI also is intended to be evaluated and scientifically studied, how to extract data and follow study participants should be carefully considered. In this thesis the development of the administration tool during the first three studies was crucial in order to be able to accomplish the studies. And the administration tool could be further developed in order to continue study the program. Additionally, the development and testing phases are described as more of an iterative process for web-based programs supporting behaviour change, where testing is conducted in every phase of the development (Figure 3), as described in studies I, II and III regarding the MSC project. Existing knowledge as the base contributes to the “concept” of the intervention. The “concept” is developed as a web-based tool, which is then tested. The test leads to increased knowledge but also to further development and change of the concept or, in some cases, abandonment of parts or the whole “concept” (West & Michie, 2016).

The model for developing complex interventions (Craig et al., 2008) and the expanded model for DBCI (West & Michie, 2016) conforms with how MSC was developed within the four studies. Testing was conducted at several stages in study I: The content was structured in a flowchart that was discussed in the research group regarding all potential algorithms, as was the paper-version of the program. The test with the paper-version comprised of the main developer (CE) chose which picture to see next depending on how the others in the research team “clicked” on the buttons in the paper version of the program. The test with the paper version comprised the main developer (CE) selecting which picture to see next depending on how the others in the research team “clicked” on the buttons in the paper version. In addition, a possible end-user proceeded through the program while being observed. In several stages, two of the researchers in the multidisciplinary team also proceeded through the program in order to detect issues with the design or how to proceed through the program. Furthermore, the usability test in studies I, II and III contributed to further knowledge and development, thus building yet more “loops” into the circular process (compare with Figure 3).

This process exists in a given context where goals, opportunities, constraints, stakeholders, collaborators and risks all influence the formation of the web-based program. The testing or development directly leads to the implementation and, if the implementation is successful, promotion of the program (West & Michie, 2016).

Figure 3. The development and evaluation process for complex behaviour change interventions, modified from West and Michie (2016)



The APEASE (acceptability, practicability, effectiveness, affordability, safety and equity) criteria are related to the context factor of the goal and provide key activities for evaluating a behaviour change intervention (West & Michie, 2016). Acceptability, practicability and, to some extent, affordability (by examining resources for delivering and evaluating MSC) were studied in studies I-III. How to study acceptability could be considered as a challenge regarding to know what is going to be searched for and to ask the right questions regarding acceptability issues. To deepen the searches for acceptability in study III from what was found in study II in a qualitative study was important in this project, even if acceptability needs to be further studied. Effectiveness was studied in study IV. Equity, to what extent MSC increases or decreases economic, social or health inequalities, was not studied, but equity was considered during the developmental process by designing content and visual elements with the aim not to confirm heteronormative stereotypes. The context factor of collaborators could concern establishing a multidisciplinary team, which has also been suggested as essential for the success of a project (West & Michie, 2016). The MSC project involved expertise mainly from four scientific fields: psychology, physiotherapy, behaviour medicine and informational design. Added to this group were the programmer, web designer and the designer of the films. This multidisciplinary team is considered as a strength, contributing to a holistic approach to health, stress and behaviour change in a web-based setting. Financial opportunities or constraints and stakeholders are also important context factors, since development of a web application is associated with high costs. Stakeholders have also been important in this project in order to give access to employees invited to participate in the different studies.

Development of applications within the eHealth area should not be seen as a fixed process over time. Changes in how to conduct development and the



elements that are important to include will differ from time to time, due largely to the rapid development still occurring in the technical area. Furthermore, a web-based intervention is never “finished” regarding development and updating. Design will look dated, and what is trendsetting regarding functionalities and design will affect possible end-users’ expectations of the product (Mollerup, 2015; West & Michie, 2016). This factor is also related to costs that must be planned for when starting a project. Finally, laws and regulations change, such as the general data protection regulation (GDPR), and keeping up to date with similar changes is essential.

According to article 12 in the International Covenant on Economic, Social and Cultural Rights, everyone has the right to the highest attainable standard of physical and mental health. That right depends on a functioning health system accessible to all without discrimination and in which occupational health is one focus (Backman, 2012). According to this requirement, it is crucial from an ethical perspective to employ a gender-sensitive (Leduc, 2009) perspective when developing an intervention. In this project, a gender-sensitive perspective was applied during the developmental process by developing features that do not confirm heteronormative stereotypes or stereotypes of who a stressed person is. This perspective is applied in the program text, pictures and films and relies on the importance of the fact that the picture itself is a message (Eriksson, 2009) that could also contribute to manifesting stereotypes. The picture itself does not contain any information or message, but the information or meaning comes alive in relation to the individual and the individual’s ability to read the picture as a meaningful whole (Eriksson, 2009).

The AAAQ framework (Backman, 2012; UN Committee on Economic Social and Cultural Rights, 2000) set a frame for this project. A web-based stress management program could make stress management training available to many and low resources is demanded. Acceptability was studied but although MSC was provided with as many features as possible found in evidence, there is still room for improvement. Still, accessibility and availability (Backman, 2012; UN Committee on Economic Social and Cultural Rights, 2000) would have been improved if the web application were smartphone compatible. MSC was developed with a responsive design, but many included elements were not optimal for smartphone viewing, although MSC is compatible with tablets. To make MSC more accessible and in order to visually remind the user to log in, a web-link from the smartphone “desktop” connected to the web application could be an alternative to a mobile application. However, unlike with a mobile application, internet access would be necessary to use the program. Unlike from when this project started, smartphones is now in every persons’ hand, and a natural development would be to transfer the application to a smartphone compatible format.

## 6.3 Effectiveness of MSC

Regarding the RCT in study IV, the results revealed low adherence and no significant difference on the primary outcome, stress, from pre to post assessment or compared to a wait-list control. Since this study included persons with perceived stress but not on sick leave, the expected outcomes were that the participants' stress levels might not change to any great extent. The inclusion of these participants may have contributed to the non-significant changes. Still, in the power calculation, this factor was taken into account based on a group with low stress in a previous study (Brinkborg et al., 2011). Due to high dropout rate, the study did not reach the expected power. Nevertheless, there was a small effect size both for between-group changes ( $d_{\text{Cohen}}=0.25$ ) and within-group changes in both the intervention group ( $d_{\text{Cohen}}=0.38$ ) and the wait-list group ( $d_{\text{Cohen}}=0.25$ ). In a meta-analysis, the effects for stress management interventions in occupational settings have shown medium to large effect sizes (Richardson & Rothstein, 2008), but the included studies were mostly face-to-face interventions that are far more resource-demanding than a web-based program such as MSC. A web-based stress-management program in one study also showed a large effect size, but it must be considered that the program was accompanied by a real-life coach (Heber, Lehr, & Riper, 2016). Cost effectiveness is one of the most argued reasons for developing DBCI (Heber et al., 2013; West & Michie, 2016), and even with a small effect size, the population intended to use MSC may still benefit from it, considering the fact that their stress have not reached levels causing sick leave. It has been shown that minimal guidance such as e-mail reminders and on-demand feedback could be of value in supporting adherence, and such programs may still be cost-effective (Zarski et al., 2016), which should be considered if developing and implementing MSC in the future.

The adherence in study IV (those completing two rounds of assessment) was 25 % in the intervention group and 34 % for the whole sample, both for the intervention and the wait-list group. Earlier studies have shown an average of 50 % adherence to web-based interventions (Kelders et al., 2012). There is no consensus in how to define adherence, and it is also doubtful to what extent adherence to a certain protocol really matters, for example, how long a person stays in a certain intervention. If the message is absorbed quickly, it may also take only a short time for an intervention to exert an effect. Studies have shown that even if a person logged in and took part in all sessions or modules of a program, behaviour change had already occurred after the first session (Ainsworth et al., 2017). It is also not unusual for users to minimally engage with a web-based self-help program. A systematic review showed that between 21-88 % of users engaged at a minimum level, such as logging in one time or completing one module (Fleming et al., 2018). How the participants engaged with the intervention should be further investigated in future studies, both in order to study what elements contribute to behaviour change and to

condense the program for enhanced time-effectiveness. The low adherence in the intervention group could, to a large extent, have depended on a technical issue that irritated some of the first participants that logged in to MSC. One hypothesis is that these early participants may also have been highly motivated to participate since they logged in directly after receiving their log-in information and might therefore have been possible completers. Regarding this issue, in order to decrease the resources demanded for the RCT, a web-based tool was developed that handled all the incoming responses to the assessments for pre, post and the intended follow-ups. This tool was tested several times before implementation, but it still contained one “bug” that caused technical issues. It is suggested that such a newly developed tool, which communicates with the web-based intervention, should also be tested in a pilot study since the technical difficulties that may be encountered could have a major effect on the study process. In studies II and III, the study participants expressed that MSC was too extensive. This result was taken into careful consideration when further development of MSC was conducted based on the results from studies II and III but may not have been sufficient to facilitate adherence.

A program like MSC is not the sole solution to work-related stress. Organizational efforts must also contribute to a healthier workplace (Michie & Williams, 2003). The more exposed psychosocial situation at work prevalent among the dropouts in both the intervention and the wait-list groups indicates that individual stress management may not occur in an unhealthy organization even if a program like MSC is available.

## 6.4 Stress, behaviour and behaviour change

Stress is, both as a concept and as a lived experience, complicated, and its costs to the mental and physical health of individuals are not to be neglected. To prevent stress-related ill health, work must be conducted at many levels. Regarding stress deriving from work conditions, the main responsibility lies, both legally and in the organizations’ interest, with the employers. Nonetheless, there is also a need for, and a will among, individuals to learn how to handle stress on an individual level. Stress can be seen as a set of behaviours where one behaviour leads to the next. Thoughts affect how we physically react, but our physical reactions also affect our thoughts. Behaviour has been picturesquely described as “Sequences of thoughts, feelings, and overt actions” that “intertwine in a delicate dance as we respond to and act upon our world” (Baldwin & Baldwin, 2001). MSC aims to support several behaviour changes on multiple levels covering thoughts, feelings and actions: the stress-related response behaviour in a specific situation where stress is experienced, lifestyle-related behaviours such as physical activity to prevent stress, and behaviours to increase the chance for the assignments to occur and to use MSC.

Defining work-related stress has been described as difficult and not straightforward throughout the literature (Hart & Cooper, 2001), nor has how to distinguish work-related stress from other stress been clearly described in the literature. Work-related stress has been defined as situations with high demand and low control (Karasek & Theorell, 1990). This definition could be seen as an extension of the resource imbalance definition by Lazarus (1993). It has been concluded that there is a gap between work-stress theory and how it is applied in web-based programs for stress management (Ryan et al., 2017). Nevertheless, the negative effects of perceived work stress do not differ from perceived stress in other situations, and the consequences as symptoms and risk for developing stress-related ill health are the same. The present project focused on what the individual can do in order to prevent stress-related ill health, but it must be noted that situations at work, such as those described above, serve as a source of stress and contribute to its development, which must be considered when attempting to prevent and manage stress. However, regarding work-related stress, the organization or employer has a responsibility to construct the work situation to avoid promoting employee ill health. Employers have a responsibility to inform employees about risks and how to avoid risks. This responsibility is stated in the regulation for organizational and social work environment (AFS 2015:4) by the Swedish work environment authority (Swedish work environment authority, 2015).

MSC can provide a tool for employers to fulfil their responsibility to educate employees in how to prevent the risks of increased stress at work and, at the same time, support the individual in changing behaviours. Handling stress on an individual level, thereby preventing the negative effects of long-term stress, is about changing behaviours. A behaviour change intervention has been defined as a service, product or some kind of activity that creates a change in the behaviour of a person, group or organization that would not have occurred in the absence of such an activity (West & Michie, 2016). MSC, and the techniques it offers for handling stress on an individual level, was developed in order to provide a holistic perspective in support of different kinds of behaviour changes, which could have importance for perceived stress and stress-related ill health. Nevertheless, changing health behaviours is difficult, which is something that many people can relate to, e.g., broken New Year's resolutions or having an intention to start (or quit) a new behaviour. SCT (Bandura, 1989) was used as a frame for the program, but to incorporate SCT within MSC may not be enough. The environment of the user of the program will affect both stress level as well as the use of a program such as MSC. This was also indicated in the drop-out analysis where the drop-outs reported a more problematic psychosocial work environment. MSC may also still have been too extensive, and the holistic approach may have been overwhelming for the users to handle, thereby also affecting adherence in the studies. This complexity may also apply to the large number of items in the questionnaires

used. Nevertheless, stress is a complex construct needing complex management such as that offered by MSC. In addition, given the difficulties of operationalizing work-related stress and its multidimensionality, it was decided to require the questionnaires employed in order to assess the participants and their complex situation.

## 6.5 Methodological considerations

This thesis focuses on health promotion among persons experiencing work-related stress. Regarding health promotion, it might be difficult to evaluate the effect on a variable that is not expected to change dramatically, such as perceived stress in this thesis. Focusing on maintaining health, as with a stress-preventive and health-promotive program, it may be that a design other than an RCT would have been more appropriate to investigate the studied effects. Because of the risk of not being able to change the already low perceived stress level in a health promotion study, large-cohort or case-study designs might contribute important knowledge that an RCT does not and could advantageously be used in further studies for longitudinal evaluations of web-based programs within the area of health promotion and prevention.

During the last decade, participatory research design has become widely adopted and has generated a great amount of research. The different levels that include end-users have been described, for example, by Arnstein (1969). The different levels of participatory research expand from involving possible end-users in the design, for example, of interventions, processes or products, to the highest level of end-user participation, described as citizen control, where the researcher can be seen as merely a tool for the research question formulated by the citizen (Arnstein, 1969). Involving users in the process offers many benefits, and it has been shown that user involvement has positive effects on system success and user satisfaction. However, participatory research design is also demanding in many respects. It demands time for both involved users and for the researcher, and conflicting requests from the involved persons can sometimes be difficult to handle (Kujala, 2003). It could also be argued that users involved might not always be able to see potential solutions to their own problems, thus omitting possible solutions (Kujala, 2003). In a meta-analysis, it was shown that games for behaviour change regarding lifestyle that were developed with a participatory research design were less effective for achieving behaviour change than games where the users were involved as testers (DeSmet et al., 2016). Nevertheless, it is important to involve the users in the development process since they are the ones who will use the end-product. They are experts in explaining their goals and how to approach a task (Kujala, 2003). In studies II and III, the possible end-users' perspective was central in order to understand how MSC was perceived and used. Furthermore, the users

in study III were repeatedly encouraged to suggest changes for further development.

The choice to conduct research with a participatory design is, in the end, a decision that reflects the ontological viewpoint of the researcher. To generalize the results from a small, highly selected group that is deeply involved in the design and development process may not be possible. It is also of importance to note that the potential end-users involved do not represent the needs of a larger sample or the population intended for future studies. The convenience sample used in studies I, II and III may not be representative of all possible end-users, but the sample contained individuals with different levels of education and different work situations, even though primarily women consented to participate. Further, regarding the most important inclusion criterion, the level of stress was identical in all studies in this project. Regardless, involving users, but in a careful and balanced way, is important. Both professional expertise and potential end-users' input should be combined to capture a broader perspective, as was performed in studies I, II and III. Evidence shows that user involvement can be appropriate in development of the features and structure of a system or product (Kujala, 2003). Involving users more in the development of the features and the structure of MSC might have contributed to lower dropout rates. Users can explain their goals and how to approach a task, such as the MSC program, even if they may not be able to communicate their exact needs or requirements for the web-based tool and the intervention (Kujala, 2003).

Qualitative studies are scarce within the field of developing internet interventions but could contribute to a deeper understanding of the development process and provide important details regarding further development. Study III, the qualitative interview study, can thus be seen as, at least to a small degree, involving potential end-users. Study III results indicated that the fact that stress management takes time for someone already stressed presents a paradox. Nevertheless, stress management was identified as something that really does take time. Users also indicated that the program seemed complicated and extensive, but it was not as extensive as first expected when users became more involved. The results in study III led to clarification of part of the program and condensation of some assignments and information. Moreover, the presentation when recruiting study participants contained information that MSC is an extensive program but that portions that do not contribute to new knowledge for the user could easily be skipped. The interview guide was based on the model for behaviour change in internet interventions (Ritterband et al., 2009) with a focus on characteristics of the web-site since the characteristics of the web-site is important for use of the program and behaviour change.

The search conducted in study I for evidence for the content of MSC was never intended as a full-scale literature review. Such would have occupied

several years. Still, choices regarding the content of MSC, i.e., stress management, for supporting behaviour change and for the theoretical framework, consisting of theories such as SCT, TRA/TPB, TTM and SoC, TSC and the model for behaviour change in internet interventions, as well as for other features in the program, were based on high-quality studies in most cases. Nonetheless, the quality of the studies found sometimes varied, for example, the stress-management strategy of pleasant activity scheduling has been evaluated in meta-analyses (Mazzucchelli, Kane, & Rees, 2010), whereas others such as assertiveness training have a lower basis in evidence (Galassi & Galassi, 1978; Imamura et al., 2014).

Regarding the internal validity in study IV, the randomization to the two branches, i.e., the intervention and wait-list groups, was successful. The randomization in blocks provided similar contexts across the intervention and comparison conditions and guaranteed that there were participants both in the wait-list group as well as the intervention group in every workplace. This process may also have eliminated the potential effect on the results of a co-occurrence of the intervention and other conditions having a confounding effect on the outcome measures. Some threats to the internal validity in study IV should be highlighted. The loss of study participants after randomization and at follow up is a threat to the internal validity since those who dropped out may have differed from those adhering to the study procedure. This loss was also the reason for the thorough dropout analysis in study IV. Moreover, the participants' level of engagement in completing all the recommended MSC modules may decrease the internal validity. However, engagement level was not studied in this study. Contamination caused by participants at the same workplace is also a threat and could be one explanation for the effect in the wait-list group. The wait-list group had no intervention or active comparator since the minimum intervention that could have been an alternative as active comparator (for example, only relaxation) could also be the only intervention for persons in the intervention group.

There is always a trade-off between internal or external validity: confidence that the found effect of MSC is truly associated with MSC versus the ability to generalize beyond the study to populations intended for end-use. Regarding external validity, it must be considered how the results from samples in studies I, II and III have been generalized (or transferred in study III) to the further development of MSC before applying it to a slightly different population in study IV. Most importantly, the main characteristic, i.e., perceived stress, was the same in all four studies. However, the differences in study samples could still have affected how participants in study IV worked with MSC, possibly also affecting the study adherence, and, most importantly, participants' work environment differed. In studies I-III, most participants had a work situation where they were free to decide how to divide their work between different tasks, while in study IV, this differed between the different work sites, with

some having a work environment where they could not by themselves decide how they planned the day.

In addition, mostly women consented to participate in all studies, which narrows the potential generalization to men. Some of the worksites included were dominated by women (nurses and social workers), but even from the more male-dominated work site, a large number of women consented to participate. Statistics have shown that women report higher frequencies of stress than men (*National health survey 2015*), which may have contributed to the higher number of women consenting to participate.

The four aspects of trustworthiness described by Lincoln and Guba (Lincoln & Guba, 1985) were considered during the analysis process in study III. Regarding credibility, during the analysis process, whenever the codes were not clearly understood, these were brought back to their context in the text and, if needed, re-coded. Dependability refers to the stability of data over time and conditions (Polit & Beck, 2011). Categories and the final theme were discussed by the research team until all felt satisfied with how the categories and theme described the findings. The dependability also considers the quality of the researcher and the training of the interviewer. The PhD-student (CE) wrote notes after each interview in order to allow reflection on the climate during the interview. The notes were also used to reflect on how the interviewer could potentially bias the results by identifying problems during the interview. The process also raised reflections about self-awareness (Graneheim & Lundman, 2004), which was discussed during the entire data collection and analysis process with the research team. Confirmability was attained during the analysis by three of the authors, who independently worked with parts of the material in order to see if there was a consensus for how the codes were created and how the sub-categories were developed. Furthermore, how the codes, categories and themes were critically reviewed amongst the authors contributes to the study's trustworthiness (Lincoln & Guba, 1985). Transferability, which is the fourth aspect, is addressed above.

## 6.6 Ethical discussion

Entering the field of self-management of work-related stress must be considered with humbleness towards potential end-users of the intervention. The work-related environment has greatly changed during the last several decades (Bahgat, Segovis, & Nelson, 2016; Jones, Burke, & Westman, 2013), which might contribute to the high sick-leave numbers due to stress (Swedens Social Insurance Agency, 2015). An intervention such as MSC could be regarded as placing a heavy burden on individuals to handle a problematic work environment on their own without support. Such direction could signal that an individual is responsible for handling this stress even though it is derived from environmental and work-related issues. However, in study IV, self-blame



dropped to significantly lower levels in the intervention group from pre to post assessment. Building the program on a framework consisting of SCT and TSC that included material on the environment's role in developing stress may have been an important aspect contributing to the feeling of not being alone in handling stress. Nevertheless, because of the small sample, this notion must be further evaluated in future studies.

Regarding ethics and web-based interventions, there is much to consider. Increasing the accessibility to treatment and interventions using the web is an important ethical benefit. Not least in regard to geographical disparities, web-based interventions can be delivered with equal access to individuals in both the countryside and cities. Accessibility expands to how the web-based program is available at any time of day that the user finds suitable. Privacy is also an important aspect and was highlighted by the participants in study III. Furthermore, convenience and cost effectiveness were found in a systematic review to be the most common rationale for web-based interventions (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006).

Nonetheless, there are also ethical challenges in relation to using the web for delivering interventions that must be carefully considered. First, possible participants must be informed about the risk of participating in studies on web-based programs and interventions. In studies I, II and IV in this thesis, the participants were informed about the program security: the use of encrypted communication both to and from the program, how data was stored, who had access to their log-in details and the administrative program tool, as well as how IP addresses were temporarily banned if there was repeatedly log in failures. They were also informed that a web-based solution could never entirely guarantee that trespassers, so-called "hackers", would not manage to intercept communication. All participants that took part in the MSC intervention provided written informed consent in order to take part in the study. All study participants had their unique log in and password that could be altered by the participant at any time. Second, the target group must be carefully considered for web-based interventions. MSC is developed for individuals who are not on sick leave but are experiencing elevated perceived stress. Stress is a condition that is frequently associated with depression and anxiety. Depression and anxiety may not be conditions appropriate for a web-based self-management program to address due to the severe consequences both conditions can present. Therefore, MSC screens all users for depression and anxiety with the HADS (Zigmond & Snaith, 1983). Those who score over the pre-set cut-off score are not allowed into the program. A notice is shown stating that the problems described are not in line with the purpose for which MSC was developed. Recommendations are also made to contact the individual's primary health care facilities or occupational health services. All included work sites were required to have an occupational health service. One of the study participants in study II was excluded due to a high score on the HADS. The participant expressed in an e-mail that this text felt appropriate to receive.

From the start of this project, the ethical issues were considered, and all of the potential ethical risks have been handled and discussed during the course of the development and evaluation to the greatest extent possible. One ethical challenge remains regarding the burden on the study participants. The extensive number of questionnaires could be seen as a burden. Furthermore, the intervention could benefit from being condensed, if possible, in order to decrease the burden on the participants. This alteration should be addressed in future studies.

## 7. Conclusions

The systematic development of the interactive web application tailored to the individual's need for stress management supporting behaviour change was based on a solid and evidence-based theoretical framework. The content is evidence-based, as is the platform from which the content is delivered. The program was validated among experts and with one possible end-user. The feasibility study findings proved the scientific study procedure feasible with minor changes, and some changes were also required for the web application to increase the chance for success in the last, larger study. However, the paradox of a stressed person, as found in study III as the theme *Struggling with what I need when stress management is about me*, must be handled. In other words, stress management and stress-preventive interventions on an individual level must be of such a kind that they do not lead to feelings of being overwhelmed with yet another thing to do. Future research should focus both on condensing the program, making it more effective and less time-demanding, and on simplifying the program to look less complicated at first sight.

Fully automated web-based programs for stress management, such as MSC, demand few resources, and, in theory, an endless number of persons could be helped, thereby decreasing stress-related illness and related sick leave. The overall findings in this thesis are thus encouraging regarding the fully automated stress-management program, MSC. The development and evaluation studies indicated that MSC can be a promising tool for self-management of stress. The effect size for decreased stress was, however, small when comparing intervention and wait-list groups, and the dropout rate was high. Nevertheless, considering that the program was developed to prevent sick-leave and tested in a population that is still at work, even a small effect size could be considered as promising since the participants already may have reached their potential to change. However, because of the high dropout rate, further development of MSC is necessary in order to be able to implement MSC at a larger scale.

## 8. Implications for future research

In this thesis, common face-to-face interventions and techniques used for stress management were translated for delivery in a web-based format, but the results were not completely successful. There is still much to discover regarding web-based solutions and not “only” translating face-to-face interventions to a web-based format. One of the main issues in the studies was the low adherence. Further studies should focus on acceptability and how to increase adherence to MSC. To better understand the users’ needs, methodologies such as think-aloud studies could contribute to an understanding of what in MSC is perceived as redundant and what facilitates adherence and supports behaviour change. This information could contribute to condensing the program, which was perceived as too extensive, thereby leading to a more time-effective intervention, which was viewed as important by stressed persons in study III. This process could also contribute to important knowledge regarding what features, modules and parts of MSC users prefer and take part in, as well as which assignments they complete and how the assignments are completed, whether online or in a paper format.

Using case-control studies, large-cohort studies or longitudinal studies could be alternatives to an RCT in further evaluation of the effect of MSC on perceived stress since the potential to change is low in a sample with a lower stress level than in a stressed sample on sick-leave. To be able to evaluate users and how they use MSC, the administrative tool could be further developed in order to see activities and follow users via a “one-way mirror” in all activities, although such a development must be carefully considered from an ethical perspective. The Multiple Optimization Strategy (MOST) (Collins, Murphy, & Strecher, 2007) is a methodology that could be used in further evaluations aiming to decrease or condense the content of MSC. This methodology’s experiments are conducted with two or more components in the intervention present or absent in a crossover design.

Sensor technologies (Begum, Ahmed, & Funk, 2007) may also be an alternative to study and to integrate in a future version of MSC. Sensors could help to limit how much information the users of MSC need to input manually. Sensors have shown to be useful in identifying stress (Sano et al., 2018) and could be reminders for supporting behaviour change.

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# Sammanfattning på svenska

Stress är den vanligaste orsaken till sjukskrivning i Sverige. Stress kan leda till flera hälsorelaterade problem så som utmattningssyndrom, depression, sömnstörningar, hjärt- och kärlsjukdom och smärta. Stress behöver hanteras i ett tidigt skede innan stressen leder till ohälsa. Webben är ett verktyg för att nå ut med stresshantering till många människor till en låg kostnad och webb-baserade program har visat sig ha effekt vid flera andra hälsorelaterade problem. Följsamheten är dock ofta låg och många program för stresshantering baseras inte på evidens. Det övergripande syftet med avhandlingen var att utveckla och utvärdera ett evidensbaserat, skraddarsytt och interaktivt webb-baserat program beteendeförändring hos personer med arbetsrelaterad stress. Projektet bestod av fyra delstudier. Delstudie ett innefattade den systematiska utvecklingen av programmet i två faser. I fas ett utvecklades programmets teoretiska ram och innehåll och fas två bestod av att strukturera innehållet och utveckla plattformen från vilken innehållet skulle levereras. Utvecklingen resulterade i programmet Min Stresskontroll (MSK). MSK är en interaktiv webbapplikation som skraddarsys utifrån individens specifika behov av stresshantering och stödjer beteendeförändring på flera olika sätt. MSK testades utifrån hur studiedeltagare klarade av att ta sig igenom programmet. Resultatet visade att flera av studiedeltagarna hade svårt att hitta till programmets sista modul, och det var otydligt att programmet hade ett slut. I den andra delstudien undersöktes genomförbarheten av den vetenskapsmetodologiska studieproceduren och hur genomförbart programmet var för att förbereda för en större, mer påkostad delstudie fyra. Fjorton personer deltog i studien. Huvudresultatet var att den vetenskapliga studieproceduren var genomförbar med mindre ändringar, men det behövdes förändringar i webbapplikationen. I delstudie tre intervjuades 9 personer från delstudie två. Syftet var att få en ökad förståelse för hur deltagarna upplevde programmet och hur det kunde vidareutvecklas. Resultatet mynnade ut i ett tema: Att kämpa med det jag behöver när stresshantering handlar om mig. Resultaten i delstudie två och tre förstärkte varandra. Huvudsakligen upplevdes programmet som för omfattande. Studiedeltagarna hade en förståelse för att stresshantering tar tid och är komplext men det var svårt att få tid till det. I delstudie fyra, en randomiserad kontrollerad studie, testades MSK i en grupp som jämfördes med en grupp på väntelista. Nittiofem 95 personer deltog i studien. Resultatet visade att programmet hade en liten effekt på upplevd stress, men många hoppade av programmet. Dessa studier visade att en webbapplikation utvecklad utifrån den

senaste evidensen hade en liten effekt på upplevd stress. Emellertid, att hantera stress på egen hand är komplext och hur följsamhet kan uppmuntras till ett helt automatiserat program behöver studeras vidare.



# References

- Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), 379-387.
- Ainsworth, B., Steele, M., Stuart, B., Joseph, J., Miller, S., Morrison, L. et. al. (2017). Using an Analysis of Behavior Change to Inform Effective Digital Intervention Design: How Did the PRIMIT Website Change Hand Hygiene Behavior Across 8993 Users? *Annals of Behavioral Medicine, 51*(3), 423-431.
- Allexandre, D., Bernstein, A. M., Walker, E., Hunter, J., Roizen, M. F., & Morledge, T. J. (2016). A web-based mindfulness stress management program in a corporate call center. A randomized controlled trial to evaluate the added benefit of onsite group support. *Journal of Occupational and Environmental Medicine, 58*(3), 254-264.
- Arnstein, S. R. (1969). A ladder of participation. *Journal of the American Institute of Planners, 35*(4), 216-224.
- Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology, 15*(Pt 2), 265-288.
- Backman, G. (2012). *The right to health: Theory and practice*. Lund: Studentlitteratur AB.
- Bahgat, R. S., Segovis, J., & Nelson, T. (2016). *Work stress and coping in the era of globalization*. New York: Routledge.
- Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: state of the art. *Journal of Managerial Psychology, 22*(3), 309-328.
- Baldwin, J. D., & Baldwin, J. I. (2001). *Behavior principles in everyday life* (4th edition). New Jersey, US: Prentice Hall.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122-147.

- Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, 44(9), 1175-1184.
- Begum, S., Ahmed, M. U., & Funk, P. (2007). *Individualized stress diagnosis using calibration and case-based reasoning*. Paper presented at the Proceedings of the 24th annual workshop of the Swedish Artificial Intelligence Society, Borås, Sweden.
- Bezner, J. R. (2015). Promoting health and wellness: implications for physical therapist practice. *Physical Therapy*, 95(10), 1433-1444.
- Billings, D. W., Cook, R. F., Hendrickson, A., & Dove, D. C. (2008). A web-based approach to managing stress and mood disorders in the workforce. *Journal of Occupational and Environmental Medicine*, 50(8), 960-968.
- Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the hospital anxiety and depression scale. an updated literature review. *Journal of Psychosomatic Research*, 52(2), 69-77.
- Bongers, P. M., de Winter, C. R., Kompier, M. A., & Hildebrandt, V. H. (1993). Psychosocial factors at work and musculoskeletal disease. *Scandinavian Journal of Work, Environment & Health*, 19(5), 297-312.
- Brinkborg, H., Michanek, J., Hesser, H., & Berglund, G. (2011). Acceptance and commitment therapy for the treatment of stress among social workers: a randomized controlled trial. *Behaviour Research and Therapy*, 49(6-7), 389-398.
- Campbell Quick, J., & Spielberger, C. D. (1994). Walter Bradford Cannon: Pioneer of stress research. *International Journal of Stress Management*, 1(2), 141-143.
- Carlson, L. E., & Thomas, B. C. (2007). Development of the Calgary Symptoms of Stress Inventory (C-SOSI). *International Journal of Behavioral Medicine*, 14(4), 249-256.
- Carolan, S., Harris, P. R., & Cavanagh, K. (2017). Improving Employee Well-Being and Effectiveness: Systematic Review and Meta-Analysis of Web-Based Psychological Interventions Delivered in the Workplace. *Journal of Medical Internet Research*, 19(7), e271.
- Cartwright, S., & Cooper, C. (1997). *Managing workplace stress*. Thousand Oaks; CA: Sage.
- Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: a theoretically based approach. *Journal of Personality and Social Psychology*, 56(2), 267-283.

- Chesney, M. A., Neilands, T. B., Chambers, D. B., Taylor, J. M., & Folkman, S. (2006). A validity and reliability study of the coping self-efficacy scale. *British Journal of Health Psychology, 11*(3), 421-437.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.
- Cohen, S., & Williamson, G. M. (1988). Perceived stress in a probability sample of the united states. In S. Spacapan & S. Oskamp (Eds.), *The Social Psychology of Health*. Newbury Park: Sage.
- Collins, L. M., Murphy, S. A., & Strecher, V. (2007). The multiphase optimization strategy methods for more potent eHealth interventions. *American journal of preventive medicine, 32*(5 (Suppl)), S112-S118.
- Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council Guidance. *BMJ, 337*, a1655
- Dahlgren, G., & Whitehead, M. (1991). *Policies and strategies to promote equity in health*. Stockholm: Institute for Future Studies.
- Dallner, M., Elo, A.-L., Gamberale, F., Hottinen, V., Knardahl, S., Lindström, K., . . . Ørhede, E. (2000). *Validation of the general Nordic Questionnaire for psychological and social factors at work*. Copenhagen: Nordic Council of Ministers.
- Dean, E., Moffat, M., Skinner, M., Dornelas de Andrade, A., Myezwa, H., & Söderlund, A. (2014). Toward core inter-professional health-based competencies to address the non-communicable diseases and their risk factors: Curriculum content analysis. *BMC Public Health, 14*:717.
- Dean, E., & Söderlund, A. (2015). What is the role of lifestyle behaviour change associated with non-communicable disease risk in managing musculoskeletal health conditions with special reference to chronic pain? *BMC Musculoskeletal Disorders, 13*(16), 87.
- Dean, E., Umerah, G., Dornelas de Andrade, A., Söderlund, A., & Skinner, M. (2015). *The Third Physical Therapy Summit on Global Health: Health-based competencies*. *Physiotherapy*. Paper presented at the WCPT Congress/Physiotherapy, Singapore.

- Demerouti, E., Bakker, A., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands-resources model of burnout. *Journal of Applied Psychology, 86*(3), 499-512.
- DeSmet, A., Thompson, D., Baranowski, T., Palmeira, A., Verloigne, M., & De Bourdeaudhuij, I. (2016). Is Participatory Design Associated with the Effectiveness of Serious Digital Games for Healthy Lifestyle Promotion? A Meta-Analysis. *Journal of Medical Internet Research, 18*(4), e94.
- Engel, G. L. (1977). The need for a new medical model: a challenge for biomedicine *Science, 196*(4286), 129-136.
- Eriksson, Y. (2009). *Bildens tyska budskap - Interaktion mellan bild och text*. Falun: Norstedts Akademiska Förlag.
- Eysenbach, G. (2001). What is e-health. *Journal of Medical Internet Research, 3*(2), e20.
- Findahl, O., & Davidsson, P. (2015). The Swedes and Internet (Svenskarna och internet). Retrieved 9 Jan, 2018 from <http://www.soi2015.se/aktiviteten-pa-internet-okar-fortfarande/>
- Fleming, T., Bavin, L., Lucassen, M., Stasiak, K., Hopkins, S., & Merry, S. (2018). Beyond the trial: systematic review of real-world uptake and engagement with digital self-help interventions for depression, low mood, or anxiety. *Journal of Medical Internet Research, 20*(6), e199.
- Folkman, S., & Lazarus, R. S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behavior, 21*(3), 219-239.
- Folkman, S., & Lazarus, R. S. (1988). The relationship between coping and emotion: implication for theory and research. *Social Science & Medicine, 26*(3), 309-317.
- Folkman, S., & Lazarus, R. S. (1991). Coping and emotion. In A. Monat, & R. S. Lazarus (Eds.), *Stress and coping: an anthology*. New York: Columbia University Press.
- Forman, L., & Bomze, S. (2012). International human rights law and the right to health: an overview of legal standards and accountability mechanisms. In G. Backman (Ed.), *The Right to Health - Theory and Practice*. Lund: Studentlitteratur.
- Government Offices of Sweden. (2016). *Vision for eHealth 2025 - common starting points for digitisation of social services and health care*. (S2016/01874/FS). Retrieved Nov 22, 2017, from <https://www.regeringen.se/informationsmaterial/2016/04/vision-e-halsa-2025/>

- Grahn, B., & Gard, G. (2008). Content and concurrent validity of the Motivation for Change Questionnaire. *Journal of Occupational Rehabilitation, 18*(1), 68-78.
- Graneheim, U. H., & Lundman, B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness *Nurs Education Today, 24*(2), 105-112.
- Grant, M. J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal, 26*(2), 91-108.
- Griffiths, F., Lindenmeyer, A., Powell, J., Lowe, P., & Thorogood, M. (2006). Why are health care interventions delivered over the internet? A systematic review of the published literature. *Journal of Medical Internet Research, 8*(2), e10.
- Hasson, D., Anderberg, U. M., Theorell, T., & Arnetz, B. B. (2005). Psychological effects of a web-based stress management system: a prospective, randomized controlled intervention study of IT and media workers. *BMC Public Health, 5*(78).
- Hasson, H., Brown, C., & Hasson, D. (2010). Factors associated with high use of a workplace web-based stress management program in a randomized controlled intervention study. *Health Education Research, 25*(4), 596-607.
- Heber, E., Ebert, D. D., Lehr, D., Nobis, S., Berking, M., & Riper, H. (2013). Efficacy and cost-effectiveness of a web-based and mobile stress-management intervention for employees: design of a randomized controlled trial. *BMC Public Health, 13*:655.
- Heber, E., Lehr, D., Ebert, D.D., Berking, M., & Riper, H. (2016). Web-based and mobile stress management intervention for employees: a randomized controlled trial. *Journal of Medical Internet Research, 18*(1), e21.
- Herrmann, C. (1997). International experience with the Hospital Anxiety and Depression Scale - a review of validation data and clinical results. *Journal of Psychosomatic Research, 42*(1), 17-41.
- Horiuchi, S., Tsuda, A., Kim, E., Hong, K.-S., Park, Y.-S., & Kim, U. (2010). Relationships between stage of change for stress management behavior and perceived stress and coping. *Japanese Psychology Research, 52*(4), 291-297.
- IBM Corp. (1989, 2016). Statistical Package for the Social Sciences (Version 24). NY, USA: Armonk.

- International Society of Behavioral Medicine. (n.d.). Retrieved Jan 18 2018 from <https://www.isbm.info/about-isbm/>
- Jones, F., Burke, R. J., & Westman, M. (2013). *Work-life balance: A psychological perspective* New York: Psychology Press.
- Jonsdottir, I. H., & Folkow, B. (2013). Stressfysiologiska mekanismer i evolutionärt och historiskt perspektiv. In B. Arnetz & R. Ekman (Eds.), *Stress - Gen, Individ, Samhälle* (Vol. 3). Stockholm: Liber.
- Jorm, A. F. (2009). Evaluations of web-based psychological interventions need to avoid the re-test artefact. *Australian and New Zealand Journal of Psychiatry*, 43(9), 877-877.
- Karasek, R. A., & Theorell, T. (1990). *Healthy work: Stress, productivity and the reconstruction of working life*. New York, NY: Basic Books.
- Kelders, S. M., Kok, R. N., Ossebaard, H. C., & Van Gemert-Pijnen, J. E. (2012). Persuasive system design does matter: a systematic review of adherence to web-based interventions. *Journal of Medical Internet Research*, 14(6), e152.
- Knittle, K., De Gucht, V., & Maes, S. (2012). Lifestyle- and behaviour-change interventions in musculoskeletal conditions. *Best Practice & Research Clinical Rheumatology*, 26(3), 293-304.
- Kujala, S. (2003). User involvement: a review of the benefits and challenges. *Behaviour & information technology*, 22(1), 1-16.
- Lazarus, R. S. (1993). Coping theory and research: Past, present and future *Psychosomatic Medicine*, 55(3), 234-247.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal and coping*. New York, NY, US: Springer.
- Leduc, B. (2009). Guidelines for gender sensitive research. Retrieved Nov 17, 2013, The International Centre for Integrated Mountain Development: <https://www.icimod.org/resource/1290>
- Lenhard, W., & Lenhard, A. (2016). Calculation of effect sizes. Retrieved 8 Nov, 2017 from Dettelbach: Psychometrica: [https://www.psychometrica.de/effect\\_size.html](https://www.psychometrica.de/effect_size.html).
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Newbury Park, CA: Sage.
- Linton, S. J., & Halldén, K. (1998). Can we screen for problematic back pain? A screening questionnaire for predicting outcome in acute and subacute back pain. *The Clinical Journal of Pain*, 14(3), 209-215.

- Lovallo, W. R. (2016). *Stress and health: Biological and psychological interactions* (Vol. 3rd ed.). Los Angeles, CA: Sage.
- Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A Comparison of the Theory of Planned Behavior and the Theory of Reasoned Action. *Personality and Social Psychology Bulletin*, 18(1), 3-9.
- Maricuțoiu, L. P., Sava, F. A., & Butta, O. (2014). The effectiveness of controlled interventions on employees' burnout: a meta-analysis. *Journal of Occupational and Organizational Psychology*, 89(1), 1-27.
- Michie, S., & Williams, S. (2003). Reducing work related psychological ill health and sickness absence: a systematic literature review. *Occupational and Environmental Medicine*, 60(1), 3-9.
- Mollerup, P. (2015). *Simplicity: a matter of design*. Amsterdam: BIS Publishers.
- Morrison, V., & Bennett, P. (2016). *Introduction to health psychology*. Harlow, England: Pearson
- Norcross, J. C., Krebs, P. M., & Prochaska, J. O. (2011). Stages of Change. *Journal of Clinical Psychology*, 67(2), 143-154.
- Nordin, M., Åkerstedt, T., & Nordin, S. (2013). Psychometric evaluation and normative data for the Karolinska Sleep Questionnaire. *Sleep and Biological Rhythms*, 11(4), 216-226.
- Nyberg, S. T., Fransson, E. I., Heikkilä, K., Alfredsson, L., Casini, A., Clays, E., . . . Kivimäki, M. (2013). Job strain and cardiovascular disease risk factors: meta-analysis of individual-participant data from 47,000 men and women. *PLoS ONE*, 8(6), e67323.
- Organisation for Economic Co-operation and Development (OECD). (2013). *Mental Health and Work: Sweden*. Retrieved March 8, 2014, from <http://dx.doi.org/10.1787/9789264188730-en>
- Polit, D. F., & Beck, C. T. (2011). *Nursing Research. Generating and Assessing Evidence for Nursing Practice*. Philadelphia: Lippincott, Williams & Wilkins.
- Pollak Eisen, K., Allen, G. J., Bollash, M., & Pescatello, L. S. (2008). Stress management in the workplace: A comparison of a computer-based and an in-person stress-management intervention. *Computers in Human behavior*, 24(2), 486-496.
- Prochaska, J., Redding, C., & Evers, K. (2008). The Transtheoretical Model and Stages of Change. In K. Glanz, B. Rimer, & K.

- Viswanath (Eds.), *Health Behavior and Health Education - Theory, Research, and Practice* (Vol. 4). San Francisco, CA: John Wiley & Sons, Inc.
- Proudfoot, J., Klein, B., Barak, A., Carlbring, P., Cuijpers, P., Lange, A., . . . Andersson, G. (2011). Establishing guidelines for executing and reporting internet intervention research. *Cognitive behaviour therapy, 40*(2), 82-97.
- Public Health Agency of Sweden (Folkhälsomyndigheten). (2015). *National health survey 2015*. Retrieved from Public Health Agency of Sweden Feb 14, 2017, from <https://www.folkhalsomyndigheten.se/livsvillkor-levnadsvanor/psykisk-halsa-och-suicidprevention/statistik-psykisk-halsa/>
- Riley, W. T., Rivera, D. E., Atienza, A. A., Nilsen, W., Allison, S. M., & Mermelstein, R. (2011). Health behaviour models in the age of mobile interventions: are our theories up to the task? *Translational behavioral medicine, 1*(1), 53-71.
- Richardson, K. M., & Rothstein, H. R. (2008). Effects of occupational stress management intervention programs: A meta-analysis. *Journal of Occupational Health Psychology, 13*(1), 69-93.
- Ritterband, L. M., Thorndike, F.P., Cox, D. J., Kovatchev, B. P., & Gonder-Frederick, L. A. (2009). A behavior change model for internet interventions. *Annals of behavioral medicine, 38*(1), 18-27.
- Ryan, C., Bergin, M., Chalder, T., & Wells, J. S. (2017). Web-based interventions for the management of stress in the workplace: Focus, form and efficacy. *Journal of Occupational Health, 59*(3), 215-236.
- Sano, A., Taylor, S., McHill, A. W., Phillips, A. J. K., Barger, L. K., Klerman, E., & Picard, R. (2018). Identifying objective physiological markers and modifiable behaviors for self-reported stress and mental health status using wearable sensors and mobile phones: observational study. *Journal of Medical Internet Research, 20*(6), e:210.
- Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire. *Educational and Psychological Measurement, 66*(4), 701-716.
- Segerstrom, S. C., & Miller, G. E. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychological Bulletin, 130*(4), 601-630.



- SFS 2017:30. (2017). Health and Medical Services Act (Hälsa och sjukvårdslagen). Stocholm: Riksdagen. Retrieved Nov 16, 2017, from the Swedish Parliament <https://www.lagboken.se/Views/Pages/GetFile.ashx?portalId=56&cat=329943&docId=2915424&propId=5>
- Shaw, T., McGregor, D., Brunner, M., Keep, M., Janssen, A., & Barnet, S. (2017). What is eHealth (6)? Development of a conceptual model for eHealth: qualitative study with key informants. *Journal of Medical Internet Research, 19*(10), e324.
- Siegrist, J. (1996). Adverse health effects of high effort/low reward conditions. *Journal of Occupational Health Psychology, 1*(1), 27-41.
- Stanton, A. L., Kirk, S. B., Cameron, C. L., & Danoff-Burg, S. (2000). Coping trough emotional approach: scale construction and validation. *Journal of Personality and Social Psychology, 78*(6), 1150-1169.
- Statistics Sweden. (2015). *Demographic reports 1015:2. Swedens future population 2015-2060 (Demografiska rapporter 2015:2. Sveriges framtida befolkning 2015-2060)*. Retrieved Jan 15, 2018, from [https://www.scb.se/Statistik/\\_Publikationer/BE0401\\_2015I60\\_BR\\_BE51BR1502.pdf](https://www.scb.se/Statistik/_Publikationer/BE0401_2015I60_BR_BE51BR1502.pdf)
- Sweden's Social Insurance Agency (Försäkringskassan). (2015). Stress - the most common reason for sick leave (Stress vanligaste orsaken till sjukskrivning). *Pressrelease*. Retrieved 7 Feb, 2016 from [http://www.forsakringskassan.se/press/pressmeddelanden/stress\\_vanligaste\\_orsaken\\_till\\_sjukskrivning](http://www.forsakringskassan.se/press/pressmeddelanden/stress_vanligaste_orsaken_till_sjukskrivning)
- Swedish work environment authority (Arbetsmiljöverket). (2015). Organisational and social work environment, 2015:4. Retrieved 12 Oct, 2016, from Swedish work environment authority [https://www.av.se/globalassets/filer/publikationer/foreskrifter/organisatorisk-och-social-arbetsmiljo-foreskrifter-afs2015\\_4.pdf](https://www.av.se/globalassets/filer/publikationer/foreskrifter/organisatorisk-och-social-arbetsmiljo-foreskrifter-afs2015_4.pdf)
- UN Committee on Economic Social and Cultural Rights. (2000). *General Comment No. 14: The Right to the Highest Attainable Standard of Health (Art. 12 of the Covenant)*. Retrieved 2 January, 2015, from <http://www.refworld.org/docid/4538838d0.html>

- van Straten, A., Cuijpers, P., & Smits, N. (2008). Effectiveness of a web-based self-help intervention for symptoms of depression, anxiety, and stress: randomized controlled trial. *Journal of Medical Internet Research*, *10*(1), e7.
- Virzi, R. A., Sokolov, J. L., & Karis, D. (1996). *Usability problem identification using both low- and high-fidelity prototypes*. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Vancouver, British Columbia, Canada.
- Vliet, H., V., & Andrews, G. (2008). Internet-based course for the management of stress for junior high schools. *Australian and New Zealand Journal of Psychiatry*, *43*(7), 305-309.
- Wännström, I., Peterson, U., Åsberg, M., Nygren, Å., Gustavsson, P. (2008). Psychometric properties of scales in the General Nordic Questionnaire for Psychological and Social Factors at Work (QPS): confirmatory factor analysis and prediction of certified long-term sickness absence. *Scandinavian Journal of Psychology*, *50*(3), 231-244.
- Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research*, *12*(1), e4.
- West, R., & Michie, S. (2016). *A guide to development and evaluation of digital behaviour change interventions in healthcare*. London: Silverback Publishing.
- Wilkinson, M. J. B., & Barczak, P. (1988). Psychiatric screening in general practice: comparison of the general health questionnaire and the hospital anxiety depression scale. *Journal of the Royal College of General Practitioners*, *38*(312), 311-313.
- Williams, R. A., Hagerty, B. M., Brasington, S. J., Clem, J. B., & Williams, D. A. (2010). Stress Gym: reasibility of deploying a web-enhanced behavioral self-management program for stress in a military setting. *Military Medicine*, *175*(7), 487-493.
- Williams, R. A., Gatien, G., & Hagerty, B. (2011). Design element alternatives for stress-management intervention websites. *Nursing Outlook*, *59*(5), 286-291.
- World Health Organization. (1948). *Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June*.

- World Health Organization. (1978). Declaration of Alma-Ata. Retrieved Nov 18, 2016, from [http://www.who.int/publications/almaata\\_declaration\\_en.pdf](http://www.who.int/publications/almaata_declaration_en.pdf)
- World Health Organization. (2005). Health promotion in a globalized world. Geneva. Retrieved Nov 12, 2016 from [http://www.who.int/healthpromotion/conferences/hpr\\_special%20issue.pdf?ua=1](http://www.who.int/healthpromotion/conferences/hpr_special%20issue.pdf?ua=1).
- World Health Organization. (2011). *Global health and aging*. Retrieved March 7, 2016, from [http://www.who.int/ageing/publications/global\\_health.pdf?ua=1](http://www.who.int/ageing/publications/global_health.pdf?ua=1)
- Yamagishi, M., Kobayashi, T., Kobayashi, T., Nagami, M., Shimazu, A., & Kageyama, T. (2007). Effect of web-based assertion training for stress management of Japanese nurses. *Journal of Nursing Management, 15*(6), 603-607.
- Zarski, A. C., Lehr, D., Berking, M., Riper, H., Cuijpers, P., & Ebert, D. D. (2016). Adherence to internet-based mobile-supported Stress Management: A Pooled Analysis of Individual participant data from three randomized controlled trials. *Journal of Medical Internet Research, 18*(6), e146.
- Zetterqvist, K., Maanmies, J., Ström, L., & Andersson, G. (2003). Randomized Controlled Trial of Internet-Based Stress Management. *Cognitive Behaviour Therapy, 32*(3), 151-160.
- Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica Journal, 67*(6), 361-370.
- Åkerstedt, T. (2006). Psychosocial stress and impaired sleep. *Scandinavian Journal of Work, Environment & Health, 32*(6), 493-501.
- Åkerstedt, T., Knutsson, A., Westerholm, P., Theorell, T., Alfredsson, L., & Kecklund, G. (2002). Sleep disturbances, work stress and work hours - A cross-sectional study. *Journal of Psychosomatic Research, 53*(3), 741-748.

# Appendix



## Interview guide study III

- Tell me briefly about yourself, such as what you work with and what your situations at work and at home look like.
- Tell me how you worked with the program and how far you came.
- Tell me what you think about this stress-management program.
- Can you describe how you perceive how the program was tailored to fit you?
- Do you see any advantages in formulating your own ABC model (Antecedent-Behaviour-Consequence model)? Tell me about these.
- Tell me about how you worked with formulating goals and thoughts about reaching them.
- How did you perceive the end of the program where you got to sum up what you have done and write a plan for future behaviour?
- What do you think about getting support from a program that does not give you personalized feedback on what you do?
- If you had the possibility to change the program, what changes would you make to make you want to use it even more?
- Do you see any advantages with having access and using the program in the future? Tell me about these.



Caroline Eklund is a registered physiotherapist with training in behavioural medicine. She graduated as a physiotherapist 2007 and has worked with patients in a surgical ward with a focus on respiratory function, burns and vascular disease. As a physiotherapist her main interest lies in how human behaviour and medical aspects interact. This interest drove her to continue to study behavioural medicine in physiotherapy on advanced level. Behaviour change supported by technology in order to maintain and improve health is the main focus for her research. The research is interdisciplinary, integrating knowledge from multiple fields, aiming to improve health in persons with work related stress. In the long run, this research may contribute to improved welfare by making evidence-based stress management available to those in risk of developing stress related ill health. Caroline is member of the research group BeMe-Health (Behavioural medicine, health and lifestyle), School of Health, Care and Social Welfare, Mälardalen University, Västerås/Eskilstuna, Sweden.

